THE DEMON OF DYSPEPSIA.

A. E. BRIDGER. M.D.

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THE
DEMON OF DYSPEPSIA
OR
DIGESTION PERFECT AND IMPERFECT.

BY

ADOLPHUS E. BRIDGER,
B.A., M.D., F.R.C.P.E.,

AUTHOR OF "BILIOUSNESS;" "ANTISEPTIC TREATMENT;" "AN EPITOME OF TWO HUNDRED CASES OF TYPHOID FEVER," &c.

Bachelor of Science, Master in Surgery, Fellow of the Therapeutical Society of Great Britain, Fellow of the Obstetrical Society of London, &c., &c.

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PATERNOSTER SQUARE.
1888

"*Nature, the old nurse, took*
The child upon her knee:
'Come, wander with me,' she said,
'Into regions yet untrod,
And learn what is still unread;
In the manuscripts of God:'
And whenever the way seemed long,
Or his heart seemed ready to fail,
She would sing a more wonderful song,
Or tell a more wonderful tale."
—LONGFELLOW.

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PREFACE.

BUT little apology is needed in offering to the British public a small work on the food supply of the human body, the means by which it is made to subserve the purposes of life, and the many and disastrous consequences which result from an opposition to the laws which rule those processes. Ten years of medical practice, devoted very largely to this branch, has convinced me that the subject is one not only of the greatest individual, but also of the highest national, importance, and that it is hopeless to look for any diminution in the vast amount of preventible disease which we see around us, until the people shall understand that the laws of nature, as applicable to the maintenance of perfect health, are simple and intelligible, and that it is directly to their interest to study these laws, and to apply them.

In the following pages I shall endeavour, first of all, to remove that great bar to a correct knowledge of one's own body, in health and in disease, which superstition, backed by ignorance, has thrown across the portals—I refer to the supernatural element. Man is subject to the same physical laws which rule all forms of matter, living or inert; and his foundation, his building, his safeguarding, and his repairing, are but the result of the action and interaction of energy and matter, the same *in kind* as those which we utilise in the building and maintenance of a house, or the construction and working of a piece of machinery. The healthy man is the outcome of a conscious or unconscious obedience to those physical laws; the unhealthy one—whether the cause of disease be in the body or the brain—a living witness to the contrary.

All scientific investigation leads inexorably to the conclusion that the Supreme Being has created similar matter, endowed with similar energies and subservient to similar laws for the living organized structure, be it plant or animal, and for all that inert motionless combination of elements of which the surface of the earth is composed; and, furthermore, that the great gaps which were formerly believed to separate the crystal from the lowliest plant, and the highest plant from the lowest animal, and the most perfect animal from man himself, do not exist, but that what we call the higher forms depend for their differences merely upon a more complex arrangement of their elements, the complexity of arrangement leading of necessity to a corresponding complexity of phenomena, including those of an apparently independent life and motion.

My object in this book is then to depict man as a mechanism borrowing force and energy from the matter around him, and converting it to the maintenance of his individual existence.

EXPLANATION OF DIAGRAMS.

No. 1 represents the course taken by foods in the body, thus:—

PRIMARY DIGESTION.

	Ptyalin (a ferment) in MOUTH.	Pepto hydrochloric acid (a ferment) in STOMACH.	Bile (a ferment) from LIVER.	Pancreatic juice (four ferments) from PANCREAS.	Intestinal juice (a ferment) from BOWEL.
Albumen	No action	Changed to peptone	No action	Residue, unacted on by stomach, changed to peptone	Residue, unacted on by either pancreas or stomach, changed to peptone
Fat	No action	No action	Changed to emulsion	Residue, changed to emulsion, soaps, fatty acids, and glycerine	No action
Starch ...	Changed to grape sugar	No action	No action	Residue, changed to grape sugar	Residue, changed to grape sugar
Water & Salts...	No action	No action	No action	No action	No action

SECONDARY DIGESTION.

	PORTAL VEIN By means of an unknown ferment.	LIVER By means of an unknown fermenter.
Peptone (representative of albumen)	Changed to circulating albumen	Changed to bile, glycogen, circulating albumen, ureas, and, to a very slight extent, to fat.
Fat	Not present	Not present.
Grape Sugar (representative of starch)	Passes on	Changed in part to glycogen, which is stored up.
Water and Salts	Pass on	Pass on, part with the circulating albumen and part with the bile.

TERTIARY DIGESTION.

IN THE CELLS OF THE BODY

By means of unknown ferments.

Circulating Albumen ...	Changed to cell tissue, to urea, uric acid, and other obscure nitrogenous compounds.
Fat and Grape Sugar	Burnt up as fuel, or stored up among the tissues as reserve fuel.

EXCRETION OF FINAL PRODUCTS OF DIGESTION.

Waste Albuminous Bodies (urea, uric acid, &c.), thrown out of body by bile and by kidneys.

Products of the Combustion of Fats and Starches thrown out of body by lungs, skin, and kidneys.

Salts and Water pass away by kidneys, bile duct, skin, bowel, &c., unchanged.

EXPLANATION OF DIAGRAMS.

DIAGRAM NO. 2 REPRESENTS DIAGRAMMATICALLY THE THREE GREAT VARIETIES OF NERVE ACTION.

A and A′ is the simple reflex act. The energy resulting from a stimulus applied to the skin travels, by the afferent nerve A, to the centre in the spinal cord, and is reflected along the efferent nerve A′ as motive power to certain muscles.

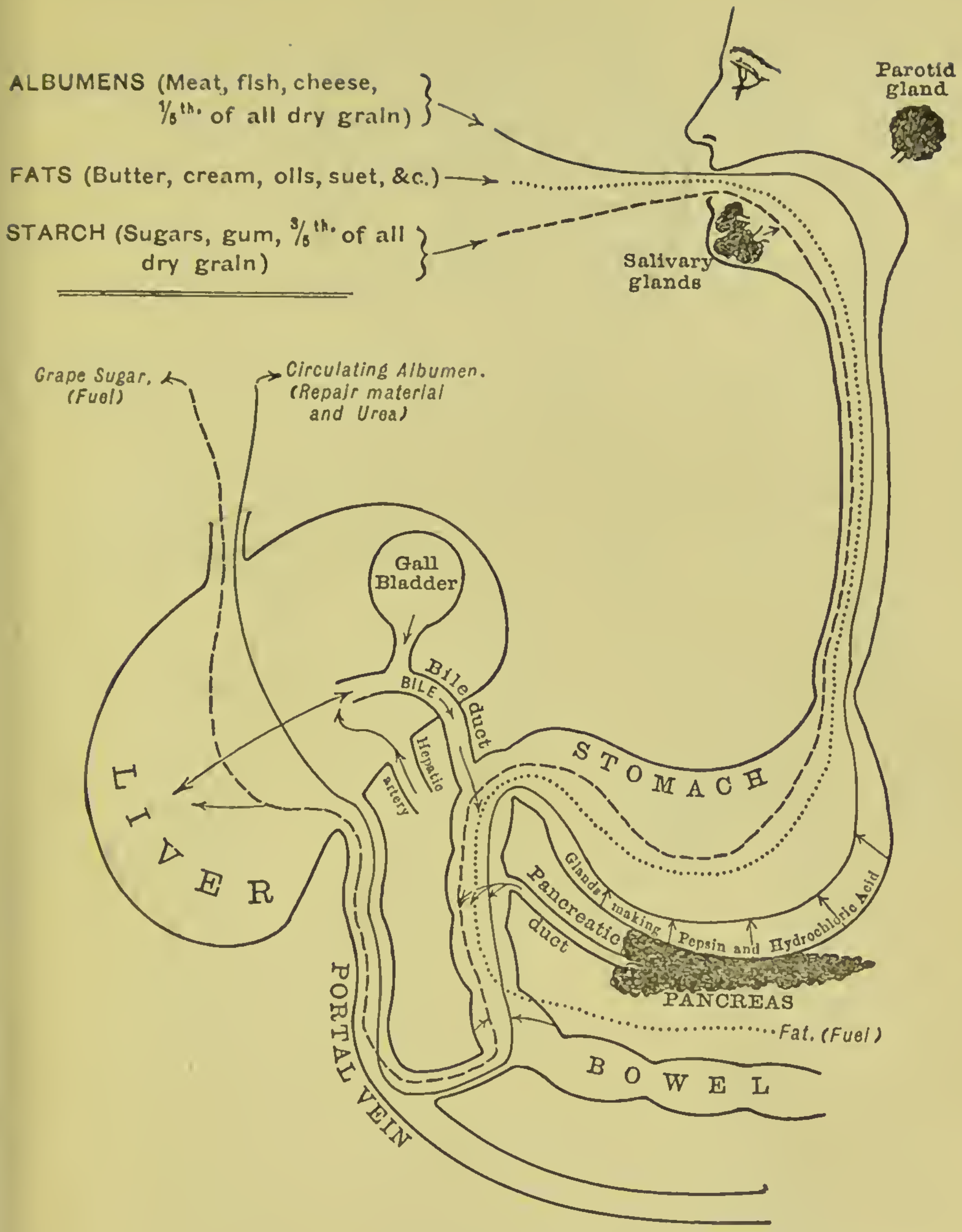
B and B′ is a higher reflex act carried out by a similar mechanism.

C and C′ is an *intellectual act*. The stimulus travelling by the afferent nerve C, goes to the centres in the brain. There, part is stored as memory (M, M), the rest is joined by other stored nerve energy (N, N), and then, passing down the outside layers of the brain, goes to various muscles, which it sets in motion.

The above description is of course but the merest outline of the great nervous plan. Millions of nerves are ever carrying nerve messages to their centres and back again, all, however, in one of the three ways I have described.

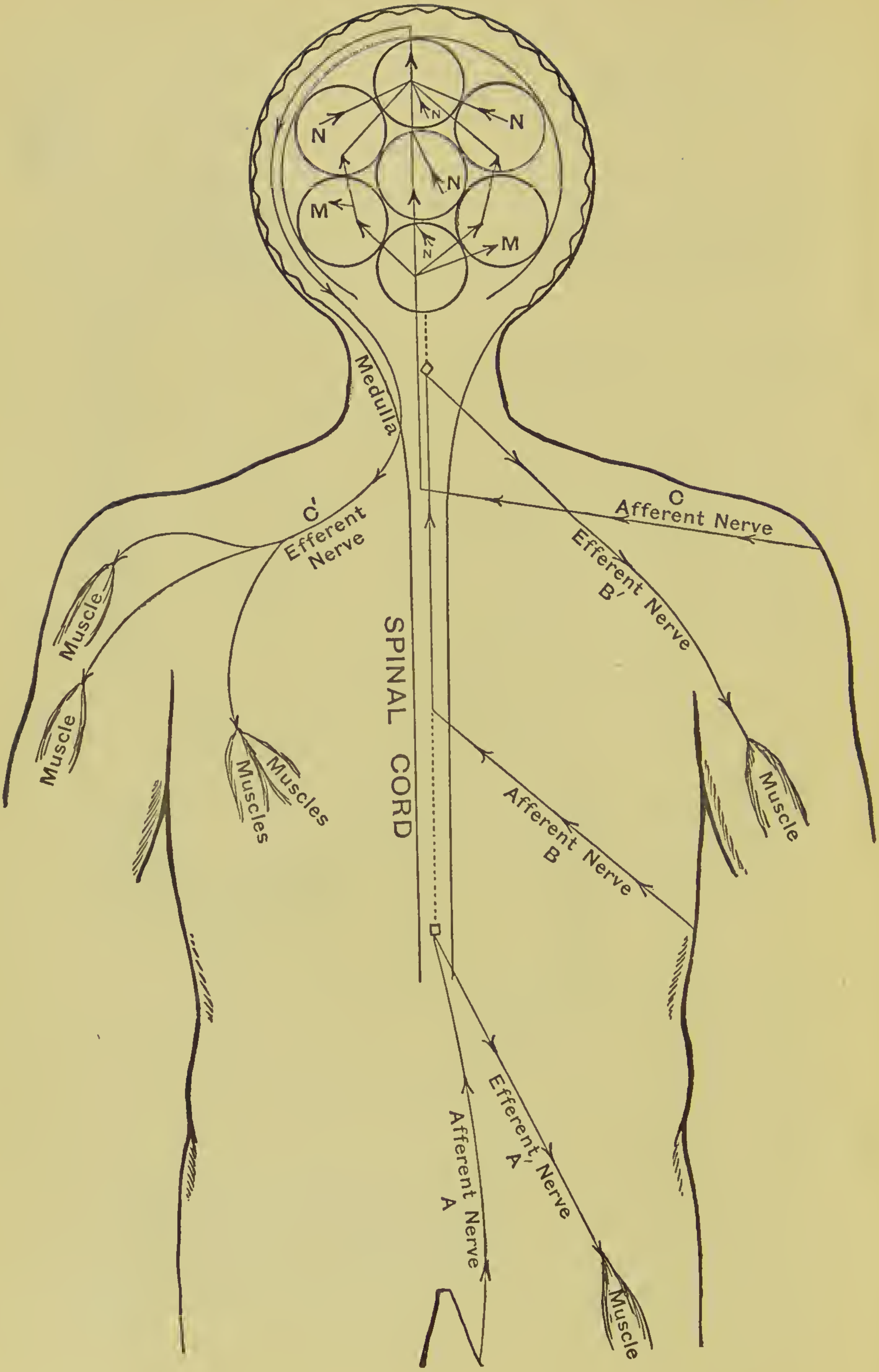
All animals, from the amœba upwards, possess reflex nerve mechanism of some kind, for the existence of a spinal cord and medulla, are not necessary thereto. The higher animals possess a brain of varying complexity, the amount of *intelligence* bearing an exact proportion to this complexity. In a clever, educated man, the brain reaches its highest developement in this respect; in savage races it stands but little above that of the monkey, ant, and elephant; whilst in some idiots it falls below the standard of complexity in those three animals.

No. 1.


ALBUMENS (Meat, fish, cheese, ⅕th. of all dry grain)
FATS (Butter, cream, oils, suet, &c.)
STARCH (Sugars, gum, ⅗th. of all dry grain)
Parotid gland
Salivary glands
Grape Sugar. (Fuel)
Circulating Albumen. (Repair material and Urea)
Gall Bladder
Bile duct
BILE
Hepatic artery
LIVER
STOMACH
Glands making Pepsin and Hydrochloric Acid
Pancreatic duct
PANCREAS
Fat. (Fuel)
BOWEL
PORTAL VEIN

Waste Albumens (Chiefly in form of Urea). going to Kidney. Similar Waste Albumens re-enter Liver by Hepatic Artery, and are thrown out as bile.

No. 2.


N
N
N
N
N
M
N
M
Medulla
C'
Efferent Nerve
C
Afferent Nerve
Efferent Nerve
B'
Muscle
Muscle
Muscles
Muscles
SPINAL CORD
Muscle
Afferent Nerve
B
Efferent Nerve
A'
Afferent Nerve
A
Muscle

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PART I.

CHAPTER I.

MAN'S PLACE IN NATURE.

INASMUCH as human life depends for its existence and continuance on the material structures, animate and inanimate, which surround it, it will be necessary, before dealing with individual man, to devote a short chapter to man in relationship to his environment.

On this earth, and indeed on all visible suns, moons, and stars, there are but two things of the existence of which his faculties assure man—*matter and energy:* everything that can be seen, heard, smelt, tasted, felt, or proved to exist, belongs to the former; every movement, every power, every force, of whatsoever kind, belong to the latter. Both are indestructible, but each is distinct essentially from the other; matter cannot become energy, nor energy matter.

Before proceeding further, let me illustrate the indestructibility of both. A bomb-shell strikes a ship; on striking, it explodes. Now the bomb contained matter, some of which was in the form of gunpowder; and it contained energy, by virtue of which it travelled through the air. With the explosion, both the energy and the gunpowder seem to disappear, but not the very smallest fraction of either has really been annihilated. The gunpowder consisted of a mixture of nitre, charcoal, and sulphur. When the shell burst, the oxygen in the nitre combined with the charcoal and formed carbonic acid and carbonic oxide gases, the sulphur took up with the potassium in the nitre, and the nitrogen, another ingredient in the latter substance, went off alone. We shall see, later on, what an important part nitrogen, from this very feebleness of its affinity for other elements, plays in living tissue, the same negative quality rendering it an essential ingredient in nearly all our explosives. The energy, by virtue of which our shell travelled, was, at the moment of contact, transferred from it to the ship's plates.

All forms of energy are convertible into other forms: thus friction may be converted to heat, to electricity, to elasticity, &c.; electrical energy may be converted into any one of the others; and thus with each and every one. In this property energy presents a striking contrast to matter, for so far no human skill has succeeded in transmuting the elements. Oxygen cannot be made from anything but itself; and so with gold, silver, and all the rest. Neither matter nor energy can be *produced* by the agency of man, they are always the result of pre-existing forms; they are both indestructible and uncreatable. They are further inseparable: energy cannot exist but in combination with matter; and, conversely, all matter must contain energy. The relative proportions in which they are present may, however, vary widely. The flying bullet is materially the same as when it lay in the rifle-barrel, but the amount of energy contained in it under the two conditions is, as we can well understand, very different. It is furthermore impossible to fix at present any limit as to the amount of energy that may exist latent in even the most minute forms of matter; in a handful of dirty-looking dust lurks the power of dynamite; in the nightingale's egg lies the future songster; in the minute cell, called the human ovum, resides the potential energy that can evolve the future man. Finally, both matter and energy pervade all space. The ether which unites our globe with the stars is but matter in a highly gaseous state, stored with potential energy.

We will now briefly examine types of the different combinations of matter that exist, commencing with the atoms of elements and terminating with the formed structure, man.

There is probably no limit to the divisibility of matter. In dealing with nature the scientist is constantly being rudely reminded of the fact that all human standards of size and space are but confessions of man's very limited and finite powers. He turns his telescope to the stars; but cannot peer into the secrets of life in them; he divides and subdivides matter, and even his microscope fails him; he cannot affirm that there is nothing smaller than what he sees there, but only that his eyesight has reached its limit. His standard of time is again merely *his own*, and has no value or *raison d'être* when applied rigidly to nature at large. The single day of life accorded to certain insects, called ephemeridæ, represents doubtless to them a long life history, and even to the most atheistical of investigators an Intelligence to whom a thousand years is but as a single day is more than a probability, regarded merely from a physical stand-point. Indeed, that space, size, time, &c., even exist is beyond the power of man to prove, and more than one excellent thinker of the present day holds that they are merely subjective sensations and not realities. The glib, half-educated men, who are often so fond of vaunting their belief in nothing that is not material, would be put to sore straits if asked to prove absolutely the existence of that very matter which they affirm to be the *ne plus ultra*.

The most minute particles of matter, of which we have any cognizance, receive the name of *atoms*. These are quite beyond the range of our vision, but their existence can, from a study of chemical action in general, be shown to be highly probable. They appear to be always in combination with similar atoms or with those pertaining to one or more other elements. Such combination is called a *molecule*. Thus the molecule of oxygen is not O, but O_2 of ozone O_3, for those substances contain relatively two and three atoms of oxygen in their molecule. But not only do the elements, such as oxygen, have a regular and invariable formula; all compounds of them have each its fixed composition. Thus the oxide of silver molecule ever consists of two atoms of silver (or argentum) and one atom of oxygen, and is therefore expressed in the following abbreviated form: Ag_2O. The compound called dioxide of hydrogen contains two atoms of hydrogen and two of oxygen, and is thus expressed: H_2O_2. A molecule, then may be defined as the smallest known particle of matter that can exist in a free state.

Now when one molecule meets another, certain fixed and known natural laws come into operation and compel, in the majority of cases, an interchange of elements. In other words, one molecule acts upon the other, and this effect is known as *chemical action.* To give an example. A molecule of oxide of silver comes in contact with one of dioxide of hydrogen, and the following is the resulting chemical action :—

$$Ag_2O + H_2\,O_2 = \begin{cases} Ag_2 \text{ or a molecule of Silver.} \\ H_2O \text{ or a molecule of water.} \\ O_2 \text{ or a molecule of Oxygen.} \end{cases}$$

The oxygen departs as a gas, the water may be driven off by moderate heat, and metallic silver remains. Now as molecules of all substances have always the same composition, precisely the same effect is produced if one or twenty billions of molecules of oxide of silver and dioxide of hydrogen meet.

The above is but the simplest of chemical actions. Even in the unorganized kingdom we meet with some which are exceedingly complicated; and when we pass to the organized one, of plants and animals, we are often brought face to face with enormous difficulties, both from the large number of different atoms that go to make the molecule, from the necessity of determining the exact grouping of atoms in each molecule, and from the instability of the molecules of living tissues, all of which contain nitrogen, the atoms of which element are for ever flitting, like butterflies, if I may use such a simile, from one molecule to another. It is, however, to this very instability of the nitrogen atoms that we owe the existence of those complicated phenomena, which, expressed in one word, we term life. Life may, in fact, be described as the resultant and outward expression of ceaseless chemical interchange.

In the sense in which I use it, the term *unorganized* includes all matter that, in popular language, belongs to the mineral kingdom. The vegetable and animal kingdoms being spoken of as the *organized.*

The *unorganized kingdom* is composed of *simple* chemical compounds, built up of similar or dissimilar molecules, which compounds may continue to preserve practically the same outline and size, under conditions favourable thereto, for indefinite periods.

The *organized kingdom* is composed of members, each of which bears a close resemblance to all the rest. These individual members are spoken of as cells, and consist of a complex material, called protoplasm, which, however it may vary in composition in the different cells, always contains nitrogen. These cells, or, if you like, this protoplasm, possesses the power of assimilating the matter of its surroundings, and working it up into its own substance, and then again giving it off in the form of simpler chemical compounds to the outside world. Thanks to its intricate chemical formula, and to the presence in it of nitrogen, it is perpetually evolving energies, which not only enable it to perform the functions just mentioned, but also to reproduce itself, to do varied forms of work necessary for the maintenance of the structure of which it forms a part, and sometimes to move freely from place to place. The living parts of all animals and plants consist simply of a collection of such cells.

The organized kingdom then feeds, digests, and builds structures similar to itself. The variations in size and shape, and the duration of the independent existence of each of the cells and of each of the structures which they form, being restricted to definite and narrow limits.

We will first briefly sketch the life-history of an ordinary plant, then we will devote a short space to the peculiarities of certain minute beings that partake pretty equally of both the vegetable and the animal, and in the next chapter we will undertake at greater length the development and history of the most highly developed of all animals—man. Let us take the seed of any of our out-door plants, one that has been kept in a dry place—a bean will answer our purpose; let us examine it thoroughly; there is certainly nothing in its outward appearance that could possibly of itself lead to the conclusion that it possessed the power of forming a plant many times its size, and capable of producing thousands of similar seeds. Let us pull it to pieces, and subject it to the closest chemical and microscopical analysis, and we shall find that its components may be separated into four divisions as regards their chemical structure, namely, water; inorganic or mineral salts; compounds of carbon, hydrogen, and oxygen, which are known by the names of fats and starches; and protoplasm, also called albumen, which is made up of carbon, hydrogen, oxygen, and nitrogen, with perhaps a little sulphur and phosphorus. Not only, however, does protoplasm contain a larger variety of elements than the other ingredients of the seedling, but it also contains them in totally different proportions.

Thus the formula of water is H_2O, that of common salt, the chief mineral ingredient, is NaCl (natrium being synonymous with sodium); that of a typical fat is $C_{10}H_{18}O$; that of starch is $C_6H_{10}O_5$; while the average *percentage* composition of albumen is $C_{53.5}H_7O_{22}N_{15.5}S_{1.6}P_{0.4}$.

It is pretty clear then that we may expect very different chemical effects from the rapid interchanges of the components of protoplasm, than what we should do from the others. Our expectations are fully realised, for it is this latter substance alone which is endowed with what we call life. The fats, starches, and salts and water exist but for its use and convenience.

The albumens vary again so widely amongst themselves in their relative number of ingredients, though they all agree in containing oxygen, hydrogen, carbon, and nitrogen, that I am compelled to give *an average and percentage* formula only; and even this does not, of course, represent *living* protoplasm itself, any more than a mass of unworked marble represents a bust by Boehm, though the chemical composition of both is identical.

To return to this admixture of four compounds, the seed. How comes it that, possessing in itself the essentials of life, it has not already sprouted? Because it lacked three necessary conditions thereto—heat, moisture, and air. Let us supply these three and place our seed in a little powdered glass or brickdust, moistened with water, and let us place the vessel containing it in a fairly warm, light room, and what shall we witness? That, although the soil contains no fertilising power whatever, yet the seed shoots, a stem forms, and green leaves are produced on it. We will now pull up the plant and place it on the scales, and we find that it exceeds many times its original weight as a seed. This at first seems difficult to account for. The water supplied, though it has assisted the increase of weight, is not alone responsible for it, for the amount supplied, plus the weight of the seed, does not equal that of the developed plant. The difference is made up of carbon, which the leaves found in the surrounding air. They have, in fact, been feeding on and *digesting* the atmosphere of the room, or rather the carbonic acid present in it, which substance their cells have, by the aid of the energies resident in light, split up into carbon and oxygen, the former of which they have absorbed into the tissues of the plant. Let us now varnish the leaves, or keep the plant in a dark room, and we shall find a daily *decrease* in weight. The stored carbon is being burnt by means of the oxygen in the air; the heat and the chemical energies evolved in the burning maintaining for a time the life of the plant. This is precisely what takes place every night with all plants that have green leaves, and during the winter when the leaves have fallen. At those times carbonic acid is given off, the oxygen of the atmosphere being consumed in the process. But how then did the plant manage to exist prior to the appearance of its leaves? It subsisted on the starch which it possessed. Now starch is quite insoluble in water; but the moisture and heat combined, caused the development of a ferment called *diastase*, the effect of which was slowly to *malt the starch*, that is to say, to convert it into sugar, and this sugar, by the aid of the oxygen in the air that existed in the interstices of the brickdust, was slowly consumed and assisted in building the stem.

So we see that the seed contains a store of carbon materials in the form of starch and fat, and that when this is exhausted, the green leaves store up carbon again. Prior to the appearance of leaves, or after their disappearance, or during the night, plants take up oxygen, wherewith to utilise the carbon, and emit carbonic acid. During the period of leaf-production, plants, in the presence of sun-light, absorb carbonic acid and emit oxygen.

Thus plants manage to *feed and digest.* Later on we shall find that mankind has to depend on starch very largely for his nourishment, and that with him also it has to undergo, prior to assimilation, a conversion into sugar.

Our plant will not, however, attain to full perfection and to seed-forming in brickdust. Transfer it to the garden bed; it flourishes and grows apace. The evaporation constantly going on from the leaves creates a vacuum, partly by the aid of which, and partly by that of fine capillary tubes, the fluid in the soil is drawn up through the roots; and this water holds in solution a variety of substances obtained from the soil—compounds of nitrogen, phosphorus, sulphur, carbon, oxygen, potassium, iron, lime, etc., all necessary for the formation of the perfect plant.

If our plant be now left to pursue its natural course, it will, after producing many seeds that will fall to the ground, itself rot away and die, giving back thus to the soil all that it obtained from it, with the addition of some carbon derived from the air. Many of the fallen seeds will sprout, and the ground will become gradually covered by plants of that species. But man robs the plant of its seeds, which he uses himself for food, and the soil becomes thus deprived of its nitrogen and phosphorus, and gradually unfitted to support plant life. To prevent this, nitrogenous and phosphatic materials are, in the form of manure, applied artificially to enrich the soil, and this very manure is but the excreta of animals, derived from the consumption of seeds and plants. Thus we have a perpetual round, the soil nourishing the plant, the plant nourishing the animal, and this latter returning to the ground, in simplified form, the material of which it robbed the earth. As we shall see in future chapters, man obtains from the plants, directly or through the medium of the bodies of animals that have assimilated them, all that he requires in the way of nourishment. The albumen he takes to repair the protoplasm of his own cells, the fats and starches to supply his necessary heat, the salts to assist the chemical conversions. Not only that, but when, through a defect in his structure, he cannot himself convert the starch he consumes to sugar, he takes from certain seeds (usually those from barley) their diastase, with which, under the name of malt, he supplies his own deficiency.

The statements that I have made with regard to the vegetable kingdom hold good of all the plants and trees with which the general reader is acquainted. Those to which the microscopist will now introduce us, as regards size, occupy an insignificant, but, as regards scientific importance, the most prominent, place in the vegetable world. These, which comprise the moulds, the fungi, and most of the ferments, reside in the border-land which separates the kingdom which we have been discussing from the animal one; in fact, some even appear to occupy the frontier line itself, so difficult is it to classify them definitely as vegetable or animal forms of life. With these debatable kinds it would not be wise to concern ourselves here; for many problems concerning them still remain unsolved, so to illustrate my subject, I will take the Yeast plant and the Ringworm plant (*Trichophyton*) as examples of border-land but vegetable, and the Nodosaria of border-land, but animal, forms, and will show how very closely in outward appearance and in powers and functions the vegetable and animal approximate.

The *yeast plant* consists simply of a string of ovoid cells which multiply in precisely the same manner as some of the lower forms of animal life, the infusoria so common in impure water, for example, namely, by budding. This plant can exist without air, *i.e.*, without oxygen, but it grows most luxuriously, though its fermentative powers are proportionably less, in the presence of that element.

The *Trichophyton* bears a general resemblance to the preceding plant, but its cells are rather more elongated. If deprived of oxygen, it propagates itself by budding; but if oxygen be present, it multiplies itself by throwing off detached cells, called spores, and it is precisely this habit of increasing, in the presence of the oxygen of the air, by numerous minute detached spores, which imparts to the disease called ringworm its peculiarly contagious character.

Now let us cross the border line and introduce ourselves to the Nodosaria. These minute animals consist of but a simple chain of absolutely structureless cells, which multiply themselves by budding.

The reader will be tempted to inquire on what I ground my classification of the Yeast plant as a vegetable and the Nodosarium as an animal. To this I reply, that the Nodosaria are endowed with independent movement, which the Yeast plant and the Trichophyton do not possess. This quality alone would not, however, suffice as a hard and fast distinction, since some animals remain all their lifetime stationary, and some plant-cells exhibit what are called amœboid (the amœba is a minute *animal*) movement; but recent researches tend to demonstrate that there is a difference in the composition of the protoplasm of the two forms of life, and that this is not a simple jelly as it appears, but a highly specialised structure. It is, however, exceedingly doubtful if even in this direction the groundwork of a surer classification of these border-land inhabitants is to be yet hoped for.

We may now regard ourselves as having entered the domain of animal life, and, without troubling my readers with a description of the structures intermediate between the Bacteria and the mammals, a full account of which may be obtained from any elementary work on zoology, I advance at once to that sub-order named by Linnæus the Primates, at the head of which, but grouped with the monkeys, lemurs, and bats, stands *man.*

For many years a bitter controversy raged about the question of evolution :—Had man been slowly developed, evolved through the various grades of animal life ; or had he, by a special act of creation,been placed much as we know him at the present day on our globe ? Notwithstanding that I have been a student of zoology at the feet of such eminent exponents of the evolution theory as Professors Huxley, Victor Carus, and Sir Wyville Thomson, I am not ashamed to avow myself still a member of the dwindling army of creationists ; whilst I concede that science is deeply indebted to the stimulus given to biological research by the late Professor Darwin, and that to him, amongst many other honours, is due the credit of having cleared an engrossing and charming study from the cobwebs which ignorance and hebetude had woven over it.

Whatever be the right view of the origin of man, one fact, sufficiently humiliating in itself, is certain, that each and every human being during intramaternal life passes through certain stages, each of which is fairly representative of the ascending grades of the animal kingdom.

In the next chapter we shall consider man as an individual; and in the succeeding one, man from the point of view of a machine. Then, with a brief description of the principles which underlie the stability of the human body, we shall pass to the study of his digestive and excretory organs.

CHAPTER II.

MAN AS AN INDIVIDUAL.

HAVING completed our sketch of man in his general relationship to nature, we will now take a short review of him in what may be called his individual capacity. Until the microscope came to the aid of the human eye, man was regarded as a somewhat complex piece of mechanism, endowed with independent life, will, and motion; each man a separate and distinct individual. This, still the popular view, is very far from being the correct one. Each man is *a country*, composed of many millions of individuals, banded together for purposes of work into communities, each community having a special function: with one community, the brain and nerves, it is the government of this country, foreign and domestic; with another, the alimentary canal, it is the assortment and preparation of food; with another, the liver, it is the manufacture and storage of the food; with yet another, the blood, it is the conveyance and delivery of food; with another, the kidney, the removal of waste and useless material; all the communities working together harmoniously for the public good.

Such is man—an orderly and well-appointed country, each individual fed and cared for by the commonwealth, and contributing in his own way to the public welfare—an ideal socialism.

We will now proceed to a description of the inhabitants of the country of Man.

In *breadth* they vary widely, viz., from $\frac{1}{120}$th to $\frac{1}{10000}$th of an inch.

In *stature* they differ as widely as they do in breadth.

In *shape*, a still greater diversity is observed. Some are round, others are goblet-shaped, others polyhedral, others flat. Some bear in outline a resemblance to stars; others again have no describable shape, but are simply irregular beyond all definition. Furthermore, many possess the power of spontaneously changing their form.

In *structure*, they appear to be simple and all alike, each consisting of a mass of gelatinous material, called protoplasm.

Some writers describe one or more little masses of protoplasm, imbedded in each distinct mass, and regard these as a necessary adjunct to all protoplasm, and give them the name of nuclei. Others regard this appearance as due to a post-mortem change. Therefore, in our definition of an individual of the country of Man, we can only say that it consists of a minute mass of protoplasm of varying size and shape. Each individual is called a *cell.*

The cell is the unit of all life, that of which every plant and every animal, in short, every member of the organized kingdom, is composed.

I hear my reader exclaim, "What right has such an insignificant structureless mass to be considered an individual, and a living being?" Precisely the same claim as the reader himself. Each cell possesses the distinctive characteristics of life; it can feed itself, it can reproduce its kind, it can exhibit distinct movement and perform distinct duties. It is true that not all cells have, or rather exercise, the function of distinct progressive motion. But neither do all of what we may call the higher animals. The limpet clings to the rock for a large part of its existence. The spongilla, whose skeleton constitutes our ordinary sponges, is attached to the bottom of the sea, being content to remain all its life where it can secure food. Some of the vorticellæ are immobile and plant-like. But no one, at the present day, would dream of denying that each of these creatures is possessed of distinct life. Nay, to descend the animal scale, let us go to the simplest of all living animals described by biologists, the *amœba*, and what do we find that the amœba consists of? Simply and solely of a mass of protoplasm. It may be *seen* in the acts of movement, of feeding, and of reproduction; and yet the amœba is simply a cell.

But not only is man built up of numerous cells; he springs himself originally from one single cell. At the moment of conception—

the real commencement of life—all that eventually develops into the hero, the statesman, financier, or philosopher is contained in just such a simple cell as I have described. This primitive cell, or ovum, as it is called, is $\frac{1}{120}$ inch in diameter. Directly it has been fertilised—a process which does not, owing probably to our limited powers of vision even when assisted by the microscope, seem to effect any difference in its composition—this primitive cell or ovum begins the business of building up the future man. The first visible part of the process consists in a rapid division and subdivision of its protoplasm, so that in the course of a few days we see produced many thousands of minute cells. This change is accompanied by an increase in size of the whole mass, due to the absorption of water from its surroundings. It, however, still for a short time retains its spherical shape. Then a whitish body appears in the centre of the round mass: this is formed by a closer grouping of the cells in that locality, and marks the commencement of the structure of the human body as we know it. During the months of intra-maternal life, this small compact body goes on increasing. At first, all the cells composing it are similar in shape, and nearly of the same size; but, before long, we notice, as the structure slowly assumes human outline, that they begin to alter considerably both in shape and size, and to group themselves, each group being composed of similar cells, and gradually forming one organ of the body. Every individual member of each group begins, as the period of intra-maternal life closes, its life-work. Those cells in the large solid central organ, which we know to be the liver, begin to prepare bile, &c., those in the connective tissue, which binds together the different organs of the body, to store up within themselves globules of fat; those in the glands of the mouth, to prepare saliva; those in the kidney, to draw from the blood certain effete material; those in the outer layers of skin, to flatten and form a species of mail, like that of the armadillo, as a protection to the organs lying beneath, and so on throughout the body. Just before, and as birth takes place, each cell and each group of cells takes up its special duty, and to the end of healthy life goes on producing cells of its own class.

I have said that the different cells composing the various organs differ widely in shape from their early spherical form. Some, such as those of the muscles, pass into lengthened shapes; others, such as those of the secreting cells of the stomach, assume an irregular cylindrical form, whilst others in the same organ become goblet-shaped or polyhedral. Those which have grouped themselves so as to form the nervous system undergo, however, the most complete transformation. At first round, then star-shaped, they at last throw out long irregular branch-like arms, which join the different cells together. But, in spite of change of shape and of function, each cell always and under all conditions of life remains what it orginally was, *i.e.*, a mass of protoplasm.

To sum up, we now see that man is built up of cells, which group themselves together to form structures called organs, each of which performsa special d uty necessary for the health and existence of the whole economy. It would, however, be a great mistake to regard each cell or group of cells as acting for itself, and independently of the cells or groups of cells in other parts of the body. At first sight we might think that there could be no connecting link between them all; but as we examine more carefully we find that such exists. In the human body, as in every civilised country, each individual is under the care of, and in submission to, the law, which can, when required, make its presence and power felt. As we look into the human structure more carefully, we become aware of a network of fine threads, whose strands separate, each strand terminating in a cell. These threads are the nerves, and the strands are the nerve-fibres which, like telegraph wires, traverse every portion of the body, and bring each and every individual unit of that body under the direct control of, and in direct communication with, the great head telegraph-office, the brain, which includes in itself that great storehouse of nerve force which we call the mind. But each cell not only requires direction and control so that it may work harmoniously with the rest of the community; it also requires nourishment and material with which to work. Both of these it obtains from the blood. This fluid, composed of red and white blood-cells, of fluid albumen—the so-called circulating albumen—of particles of fat, of salts, and very largely of water, is distributed in pipes to each organ of the body, the pipes dividing and subdividing, each successive subdivision in size resulting in a pipe with a thinner wall, till at last each cell draws its food supply from blood-vessels with walls so thin, that the white blood-corpuscles and the serum-albumen and much of the water and salts can pass out and in without difficulty. Thus each cell is fed. From the same source its working material is drawn.

We see, then, that each cell is supplied with food and working material by the blood, and its action controlled, and probably its life maintained, by its connection with the nervous system.

I have compared the whole structure of man's body to a country in which a state of ideal socialism exists, each individual cared for, working for, and fed by the commonwealth. I must carry this point a little further, and show in what limits and under what conditions blood, *i.e.*, food and work, is supplied to each unit.

Each cell is not at all times equally nourished, but is supplied with blood in amount exactly proportionate to the work it has to do, and, *vice versâ*, it can do work only in proportion to the blood it receives. The body contains only a fixed supply of blood, about one-fourteenth of its own weight. We know that at certain times some organs, such as the stomach, are called on to do a large amount of work, whilst at other times they are permitted to rest. What is true of the stomach in this respect is true more or less of every structure. Now, from what I have already said, it is clear that, if the cells of the stomach in active work contained only that amount of blood which they possessed when at rest, the work could not be done. Some arrangement, therefore, becomes necessary, since the whole amount of blood is constant, whereby an organ or organs shall be supplied with blood proportionate to the work it has on hand. This is effected by a very perfect contrivance. The pipes which convey the blood are, like every other structure of the body, formed of layers of cells, and the minutest pipes of all, those which supply each cell with food and work, consist but of a single tessellated layer of flat cells. Now each of these cells has a small nerve-twig running to it, the duty of which consists in maintaining a certain amount of contraction, or dilatation in the cells of the blood-vessel's walls, thus regulating the calibre of the channels themselves.

The action of the nervous system in carrying all impressions to the brain or spinal cord, and in conveying back those impressions so as to produce the dilatation of blood-vessels, the movement of muscles, and so on, is the great function of the nerve-twigs ; and such an action as I have described is spoken of as a *reflex action*, or an action reflected back from the brain or nerve-centre. To lay minds, the above processes are difficult to comprehend, and yet almost every movement of our bodies is an example of a reflex act. Many of them, such as the one I have described, are beyond the controlling power of the will. A good example of an involuntary reflex act may be seen by allowing the leg to hang loosely over the edge of a chair or table, and then, with the side of the hand or the back of a thin book, giving a smart blow just below and in front of the knee-joint. No effort of the will can, if the patient's nervous system be healthy, prevent the foot of the leg, so struck, from starting forward.

Thus in the way I have described in speaking of the stomach-cell, is every organ, and every cell of every organ, supplied with the blood it requires for the performance of its duties. It will, from a consideration of this matter, be clear that no two or more organs can, at the same time, perfectly perform *full* work. Every-day experience shows us how important it is to remember this point. I will give a homely illustration. A is leading a healthy life, and does a moderate amount of general work, and is able to enjoy and digest his food ; in fact, as he expresses it, does not know what indigestion is. To this happy time succeeds a period of worry, anxiety, or increased work, any or all of which imply extra thought, extra brain-work, and therefore extra blood supply to the cells of the brain. This increase of blood in the brain involves a necessary decrease in the cells of other organs of the body, and a lessened capacity for any work suddenly thrown on them. The first call for working material comes now from the stomach-cells, when a full but hitherto quite digestible meal commences to stimulate them. The stomach-cells, however, can only secure a portion of the blood they require, for the brain still retains more than it used to do at meal-times, and therefore can only perform a portion of their work. Part of the food remains, therefore, undigested, ferments, and sets up distressing symptoms of pain in his abdomen.

A goes to the doctor, who indicates the different courses which can lead him back to health. He either must cease to work his brain as much as he has done, or, if he cannot manage that, he must give his brain half an hour's rest before a heavy meal, so as to allow of its emptying itself in part at last, or he must proportion the amount and kind of his food to the lessened strength of his stomach-cells, and this he can do while yet supplying himself with all the nourishment his system really needs; or, finally, he must stimulate the cells of his stomach by taking bitters, cayenne tincture, alcohol, etc., just before his food, which will have the effect of transmitting through the cells such urgent messages to the brain that a sufficient supply of blood may yet be secured by means of the reflex mechanism.

If A be a wise man, he will adopt one of the first three courses, or, better still, a combination of the three: if he take the fourth road, he will, it is true, seem for a time to get on very well, but in the long run the outcome will, and *must be*, disaster.

But to return to our subject—the description of the country of Man. Every country must have its government, and the one we are descibing is no exception to the rule.

The country of Man, then, has a government, and, like every well-regulated country, a government of dual form: firstly, a supreme and intellectual one, whose office it is to plan and consider means for the public good, and originate and effect necessary internal reforms, and to ensure for the country a high place in the competition with other states; and, secondly, an executive, more or less automatic one.

In Great Britain the higher government is placed in the hands of the sovereign and the two Houses of Parliament. The other department, the members of which carry out, night and day, summer and winter, whether Parliament be in session or not, certain duties essential to the well-being of the people, and which consist in the maintenance of order and the carrying on of communication between the different towns and villages, may be said to be in the hands of the police, post office and telegraph officials.

The work of the latter must be constant and regular, whatever political party be in power.

We shall see that the mode of government in the country of Man approximates very closely indeed to that found in Great Britain. The supreme ruler, the brain, directs the actions of the country when the country acts as a whole. It transmits its orders by means of the nerves; it controls the whole foreign policy of the country, and exercises a general supervision over its internal economy. Its power, like that of Parliament, is not by any means constantly and actively at work; for it passes, in rest and sleep, at least one-third of the time. When foreign relations become strained, or civil war appears imminent, in other words, in times of perplexity and of bodily derangement, the brain works hard, requiring subsequently rest in proportion to the extra work it has been called on by such various emergencies to perform. But these very periods of rest and sleep necessitate the existence of a second, less intellectual, but constant and systematic department. In the country of Man this department, to which the reflex actions of which I have already spoken, belong, is supplied largely by the agency of the sympathetic and spinal nerves, and the heads of the department reside, not in the brain proper, but in what are called "reflex centres," in the spinal cord and the medulla, as the flattened-out portion of the cord which unites it to the brain is called. This department, some members of which are ever on duty, correspond precisely in their duties and functions to the police and post-office officials of Great Britain. And this general analogy between man and our country is rendered, as regards their respective governments, even closer when we consider that though the higher or political government can, but rarely does, directly interfere with the duties of such permanent officials as police officers, when their duties are well performed, so the brain of man possesses connections by means of which it can, if necessary, but rarely does, control and interfere with the functions of the subordinate reflex-nervous system.

But, on the other hand, as a weak or panic-stricken political government will sometimes unwisely turn its lower permanent officials into active political partisans, so the brain of man, when depraved, will occasionally, as in hysteria, assume a direct and active interference with that executive department which has its quarters and offices in the spinal cord and medulla.

Man, then, is a country not an individual, a country composed of countless living units, called cells, each unit working for and nourished by the commonwealth in exact proportion to the work it has to do. The units band themselves for the purposes of work into societies, called organs, each society producing just sufficient of its special product to maintain the commonwealth. The commonwealth is ruled by a dual form of government, a higher, intellectual, controlling department; and a lower, automatic executive system.

CHAPTER III.

MAN AS A MACHINE.

In the preceding chapter, we have taken a short and rapid survey of man, in his development from a single cell, into a vast community of cells grouped together as organs to constitute one great entity; or leaving aside the questions of life and function, we may put it simply thus:—a collection of similar cells constitutes an organ; a collection of organs constitutes a man. We must now set ourselves to consider the order in which those organs occur, and the manner in which they succeed, for a certain period, in maintaining, in the individual man, that relationship to his environment, and in producing those phenomena of thought, will, and motion, which, taken collectively, constitute what we know as animal life. I have selected as the thesis for this chapter, "man as a machine," and it is simply and solely as a machine that I shall now proceed to regard him.

What are the functions of a machine? Simply to do work. The work may be the production of electric light, the conveyance of persons along a railroad, the indication of time on a watch-dial, or the making of stockings. All machines are driven or worked by *energy*. The electric light is due to the energy of resistance, inherent in certain metals, to the passage of electric energy, this electric energy being, again, due simply to a conversion of the heat and friction energies in the machine which produces the current. The movements of a railway engine are due to the conversion of chemical energy, derived from the coal and the oxygen of the air, into heat-energy; and heat-energy, by the medium of water, into kinetic energy, which, transferred from the boiler to the cranks and wheels, sets up and maintains motion in the driving-wheel. The motion of the knitting-machine is due to the energy of muscular contraction in the individual who works it, which energy is derived from nerve-energy (probably electro-chemical energy), which again, in its turn, is due to the potential energy derived from the food consumed and stored up by man in his cells. Work is, then, the result of the action of energy on matter.

Work varies widely in kind. It may consist in the rapid and constant interchange of atoms between organic molecules, and then called life; in the vibrations of the small ether-atoms that occupy all space, and called light; in the undulations of the air around us, and called sound. The work that the body of man is called on to perform is movement—molecular movement in his cells. Whence does he derive the energy necessary for this work? From a certain store of potential energy derived from his parents and from his surroundings. And what does man do with the energies derived from these sources? Part of them he uses immediately, and part he converts into other forms and stores up.

That sometimes all are utilised, is seen in simple reflex acts, where the return energy *from* is equal to the energy *to* the nerve-centre. That oftimes some is stored in the brain-cells, to be evolved at will, and called by us *memory*, will require explanation. Let us make a very simple experiment to illustrate the storage of energy. If we take an iron nail, wrap it round with straw, so as to insulate it, then wind one of the wires from an electric battery round the straw, and finally join that wire to the other, so as to complete the electric circuit, we shall be rewarded by finding that the nail has taken up a certain amount of energy from the electric coil, and has *stored* it as magnetism. And yet the electric energy passed the nail unchanged in kind. Or, let us observe a blacksmith render a piece of iron red hot, by merely hammering it. In this latter case, the energy evolved from the man's muscles and transmitted to the hammer, *plus* a certain amount of that form of energy which we call gravity, is converted into heat *stored* up in the iron, and vibration and. elasticity, both forms of energy, communicated to the anvil on which the piece of iron rested.

Man, then, as regards his physical structure, possesses all the characteristics of a machine, viz., a body that, up to a certain limit, in return for the fuel it burns and any other energies derived from nature, evolves, as required, a corresponding amount of work, such work always taking, in one way or another, the form of motion. He differs from all other simpler machines, inasmuch as the ovum from which he springs possesses a large store of potential energy, which, liberated at the moment of conception, renders him for a period (named *the duration of life*) corresponding to the amount of inherent energy, and the rate at which it is converted into other forms, self-constructing, self-repairing, self regulating, and self-feeding.

Now let us consider man first of all as a simple machine, and consider, later on, the existence of and the effects produced by the initial energy which comes to him in the parent ovum. Perhaps of all the machines with which we are acquainted there is none that, taken altogether, so closely resembles man as the ordinary locomotive engine. The similitude, of course, is confined entirely to the working of both. The object of the locomotive is to produce motion, which can be made available at the will of the driver, for performing a certain amount of work. Now work is, as we have seen, the result of the effect of energy on matter. The matter in this case is the whole structure of the engine, its cranks, wheels, driving-gear, boiler, &c. The energy is derived from the combustion of coal in the presence of air ; this results in heat-energy, which, brought to bear on a volume of water in an enclosed space, produces, by means of the expansive powers of that fluid in a state of boiling, the movement of the whole machine.

Of course the above is a mere sketch. I omit, for brevity's sake, a description of the way in which this power of watery vapour, called steam, is made by man's ingenuity to move the engine, as a full description of the process is contained in all elementary books on physics. The engine then requires coals, a tender in which a reserve store of coals is kept, a furnace in which to burn them, and a sufficiency of air to render combustion possible. In chemical language, coal is a compound of carbon, oxygen, and hydrogen. The only portion of the air that is used in the act of combustion is its oxygen, and in fact oxygen, pure and simple, would produce a much more brilliant fire. The effect of the oxygen derived from the air on the coal is to produce carbonic acid, a compound of one part of carbon to two of oxygen—and water, which, as we know, consists of two parts of hydrogen to one of oxygen. But no coal is absolutely pure, nor is the supply of air ever perfect enough to render its combustion complete, therefore we have always a residue called *ash.* Briefly stated, then, a steam engine is enabled to do its work by the means of the effect on water of the heat-energy which is evolved in the combustion of a compound of carbon, hydrogen, and oxygen, which is called coal, in the presence of the oxygen of the air, a certain amount of unburnt fuel, called ash, being always left over.

Now man resembles the steam-engine in all the above particulars. He possesses a tender, which in him is represented by the stomach and intestines. These are kept duly supplied with compounds of carbon, hydrogen, and oxygen. These, in the precise quantities needed for combustion, are, by means of certain channels which will be described more fully hereafter, regularly placed in furnaces, and disposed of as *fuel.* The combustion is, it is true, more slow than in the engine, and hence so much heat is not evolved; but it is simply and precisely the same process in both cases, and results in precisely the same products, *i.e.*, carbonic acid and water. But the fuel foods with which man is supplied are not, any more than coal, absolutely pure. The incombustible part is rejected, and is cast out of his body in a manner very analogous to that by which the ash or cinders in the engine drop into the ash-tray. Finally in man, as in the steam-engine, the heat energy evolved in the process of combustion is made use of to produce all the necessary movements of the machine.

I must here stop for a moment to say, that whenever oxygen acts upon any substance so as to produce a chemical decomposition, whether the process be rapid, as in burning, or slow, as in rusting, the substance acted on is said to undergo *oxidation.* This term will, in future pages, appear so frequently, as it is one of the most frequent changes in nature, and might seem to the reader to be employed in such dissimilar effects, that it is necessary to give this short definition of it.

I anticipate, on the part of the reader, two apparent objections to my simile. The engine emits smoke, and man does not. This is simply because the steam-engine is mechanically but an imperfect machine. The black smoke and the particles of black grit which it contains, are simply unburnt carbon. Again, before the coal can burn, it must be ignited, and ignited with something that is so hot as to emit light—burning wood, for example. In the case of man, a heat, proportionate to the amount of combustion which is required, is supplied by the maternal body before the human machine makes its *début* on the stage of life as a distinct being, and the furnace being once lighted, both in man and the steam-engine, goes on burning, so long as fuel is supplied and the machinery is kept in sufficient repair. That light results from the combustion of coal in an engine, and not of the fuel in man, is simply a result of *the rate* of combustion.

Now this word, *repair*, opens the way to another question. How does man, the machine, repair himself?—for we know he exhibits, in his power of *self*-repair, a very striking contrast to his inanimate fellow-machines, the creatures of his power. And the necessity for repair implies the fact of waste. The *structure* of a steam-engine wastes. It is composed, as we know, of iron in some shape or form. Every known element, except an unimportant one, called fluorine, when in contact with oxygen undergoes combustion; in other words, it *oxidises.** Iron is no exception to the rule, and whenever it is exposed to air an oxide of iron is slowly formed, and this oxide crumbles away. The process with iron is a slow one, for iron burns but very slowly in air, though it may be made to do so brilliantly in oxygen gas, and the process, as it occurs in iron exposed to ordinary air, is called *rusting.*

The structure of the human machine is composed of cells, in other words, of protoplasm, and protoplasm, as we know, is a compound of nitrogen, oxygen, hydrogen, and carbon, containing often, in addition, sulphur and phosphorus. Protoplasm oxidises, and oxidises very slowly, just as we saw that iron did; and when it oxidises it may be said, like oxide of iron, to crumble, for it becomes disconnected from the rest of the structure in very minute portions. Therefore, even as far as their wear and tear are concerned, there exists an almost perfect resemblance between the steam-engine and man. But when the structure of the engine wastes by rusting, the aid of a skilled mechanic has to be invoked, and it is by his aid that restoration of the worn-out material is effected. Man, as a self-repairing machine, possesses an *inherent* power of repair. We will not stop just now to inquire in what way he has acquired this power, for that question involves an attempt to describe the potential energy, derived from his parents, and with which he commences life, and that subject will be treated of in another place. We will only now consider the method by which self-repair is effected.

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* It is a widespread but erroneous belief that oxygen is essential for *all* combustion; but this is not an absolute rule, for phosphorus will burn in an atmosphere of chlorine gas. Combustion, in fact, is but chemical combination proceeding in a very energetic manner.

Man places in his tender, along with his fuel foods, a certain amount of *tissue* foods. These are transferred with the fuels from the tender to the furnace, but, being only slightly combustible, undergo, in comparison with the fuel, but a trifling amount of oxidation there, and are conveyed, by means of the blood-channels, to the wearing-out tissues, there to effect the necessary amount of renewal. The material that has crumbled, and which receives the name of urea, is conducted to what may be called the ash-trays of the human machine.

Now protoplasm is a compound, as we have seen, of at least four, more probably of five or six elements, and nature exacts that her structure called man shall be renewed with material similar to that of which he is built, just as, if we possessed an iron steam-engine, we should insist that it should be repaired with iron; and various substances, all containing nitrogen and closely allied in composition to protoplasm, for they are but dead protoplasm, occur commonly in nature. These have received the name of *albumens*, and are utilised by man as tissue-foods.

But besides fuel-food and tissue-food, there is a third, a subsidiary but absolutely necessary food for man, and which consists of various inorganic salts. It is true that the amount of food of this last kind that a man requires is but a trifle in comparison with the two other forms, but, small as is the demand, it is an essential condition to the working of the machine that it shall be supplied. A grave question might arise, and such a question has before now arisen in the scientific world, as to whether salts are to be regarded as food at all, in the proper sense of the word. They reappear in the ash-trays of the human machine in the same state as they enter the body. They do not supply heat-energy, and, with very questionable exceptions,* they do not furnish repair-material. Their main, probably their sole function, is to assist chemical action. They may very fairly be compared to the oil used in lubricating the machinery of a locomotive.

I have said that for repair-material man utilises the protoplasm of the animals and the plants, and it is very intelligible that such material should be best fitted for the repair of his own protoplasm. Let us consider what he uses as fuel. At first sight it might seem that anything combustible would suit him, or that, since he was a machine, coal would be just the thing for him. But in selecting material for combustion in any machine we have to consider both its rate of combustion in connection with the supply of oxygen, and the proportion which this bears to the rapidity and amount of work to be done. In the steam-engine we have a good supply of oxygen, and we want what may be called a substance of medium combustibility, to produce powerful energy, and yet not to be too rapidly consumed, and coal is such a substance. We could not get the work we require out of a steam-engine by burning straw, nor even by consuming iron, and yet both those substances are combustible. So, in seeking for fuel with which to supply the human machine with motive energy, we must find material more combustible than coal, not because we need to evolve a very large amount of energy, but because the supply of oxygen is very small.

Now there are two chemical substances suitable for the purpose in hand to be found in nature, both, like coal, belonging to the organized world, and one (the fats) belonging to the same chemical series of the hydrocarbons as coal, and these are called *the sugars*, or starches, and *the fats*. There are other fuels which man can burn, but they do not possess that proportion of combustibility to work, which is necessary for his duties in life. Alcohol is a fuel of this order. It is capable of being burnt in the human body, and is so burnt; but, like the straw in the furnace of a steam-engine, if used alone, it merely makes a flare, if mixed with the coal, its rapid rate of combustion as compared with that of coal leads to its taking to itself the lion's share of the oxygen of the air, hindering the combustion of the coal, and thus, and by clogging the ash-box and the other fuel with its burnt *débris*, it retards rather than assists the work of the machinery. Now, as we shall see in a future chapter, this is almost precisely what alcohol does when used alone, or in considerable admixture with other fuels, for the purpose of working the human engine. The chemical class to which the sugars or starches belong is that of the carbo-hydrates; that to which the fats belong, that of the hydrocarbons. Both are closely allied in composition, and either alone is sufficient in itself as fuel for the human body.

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* It is true that potassium salts occur in muscle, but they are not a part of the structure of muscle-cells; sodium salts in the blood, but they form no part of any living structure there; phosphorus salts in bones, but here again as a deposit rather than a part of protoplasm. The phosphorus in the brain and nerve-tissue is not in the form of an *inorganic* salt at all.

Man requires, therefore, for the repair of his structure tissue-food, which he obtains from plants and animals in the form of dead protoplasm; to this he gives the name of albumen or nitrogenous food, for, unlike his other forms of food, it contains the element, nitrogen. He requires for the exhibition of motive energy fuel-food, of which two suitable kinds are found in nature, both of which are derived from plants or animals. These are called hydrocarbons, or fats, and carbo-hydrates, or starches and sugars; but either of the fuel foods will suffice alone for the production of all his motive energy. As adjuncts to combustion he also requires certain salts. Finally, the oxygen which man requires for his furnace is drawn into his lungs in the act of breathing; there the red blood-corpuscles, by virtue of a substance they possess, called hæmoglobin, extract the oxygen from the air for conveyance all over the body, while, at the same time, they emit the carbonic acid, with which in their passage through the body they have become charged. Water, in the form of vapour, is also largely exhaled from the lungs.

Now let us draw a few practical deductions from what has been said. If man be a machine, and we want him to produce the work that a machine of his class has to do, it follows,—firstly, that we must understand the construction and working of the machine; secondly, that we must keep its structure in good repair; thirdly, that we must supply fuel in proportion to the work required; and, fourthly, that we must provide a sufficiency of oxygen to burn our fuel. Conversely, all the derangements and the deficiencies found in the machine, excepting those which are the effect of external influences, and these are comparatively easy to discover and to avoid, arise from a want of one of the four conditions above named.

It is quite clear that we must understand the structure of our machine, and must recognise the fact, too often forgotten in the case of the human machine, that, if it be not kept in good repair, it cannot possibly effect the work we require, however well it may be supplied with fuel. That we must supply fuel in proportion to the capacity of our machine for work, and to the work in hand, is also plain; for if, on the one hand, we supply it in excess of the needs, we shall choke the furnace, and *less* than the proper amount of work will be done; while, on the other hand, if the supply be too little, a similar result will be obtained. All these points are of very great practical importance. The gouty man is either an individual who descends from ancestors who clogged their furnaces by overfeeding, or who has himself made the same mistake; or an individual whose ancestors were, or who himself is, systematically *underfed;* both processes, overfeeding and underfeeding, equally producing this and many other diseases. My fourth point, viz., the need for a sufficient supply of oxygen for the combustion of the fuel supplied, is so self-evident as to need no enlargement.

Now if man were like a steam engine, always possessed of the same structure, wherewith, in conjunction with energy, he could perform work, and if the computation of that work were easy, as in the steam engine, the amount of fuel he would require would be also easy to determine, and the avoidance of the many derangements due to a want of knowledge on that score would be avoided. But the structure of man, as far as its power of doing work is concerned, varies widely at different periods of life, and according to many minute differences in each individual, which it is difficult to estimate; and the amount of work which he has to do, though it may be said to consist of motion, yet comprises so many forms of motion that the necessary sum-total is difficult to gauge. But, though these differences and difficulties of calculation exist, man can, by the aid of his intelligence, master many, if not all, of them, or can at least save himself from the consequences of gross ignorance, and it is the main object of this book to lay down easy and simple rules whereby that desirable end may be attained.

We have now finished with the points of resemblance between man and a locomotive engine, but we have not, by any means as yet exhausted his similarity to machinery in general. I have called man a very complex machine. He is indeed so complex that there is no *single* human result of ingenuity to which he can be compared. He is not only supplied with motive energy by means of combustion; he is also *self*-feeding, *self*-repairing, *self*-regulating, and *self*-constructing. But feeding and repairing are in the human machine, as we have seen, really but one process, and, given a supply of necessary food and a power of self-regulation and self-construction, and the powers of self-feeding and self-repairing will follow. We can, therefore, pass at once to a study of the mechanism of self-regulation and the means of self-construction.

Man is a self-regulating machine. In his construction he is supplied with a certain mechanism, called a nervous system, by means of which he can *receive and store* the energies in his surroundings and emit them in other forms. We have in some machinery an analogous state of matters. The windmill and the sailing-vessel convert the energies of their environment to other forms of motive energy. The engineer makes use of the energy of moving water to drive a mill, or to produce electricity, which he can convert again into light-energy. The telephone converts the energies inherent in the air-waves produced by sound; and simple sun-light contains in itself such a vast store of energy that it supplies this world and many others with nearly all, if not all, their forms of energy or work-power. All we require, then, to apply the energies existent in nature to any given body is a mechanism suited for the purpose. The human machine possesses, in the nervous system, a most precise and beautiful mechanism, specially adapted to this end.

We must now try to master the general principles of this nervous system. Its plan, as seen in the diagram at the commencement of this book (No. 2) is very simple. It consists of, 1st, *a storehouse*, the brain, containing divisions for the systematic sorting and pigeon-holing of energy; 2ndly, *a vast array of tiny twigs, like electric wires*, which are spread over the whole of the system, and of which every cell in the body receives one. At the terminations of each of these nerves in the cells is placed a tiny mechanism, called an end-bulb, comparable to the diaphragm at the end of the telephone, which, like that diaphragm, collects certain impressions or energies with which it comes in contact; these energies, collected by the end-bulbs, are converted into nerve energy,* travel along the nerves to the brain, are wholly or partially stored there, and are liberated by fresh impressions; 3rdly, a second set of nerve-twigs for the liberation of this energy; these run *from* the brain, and carry the nerve energy liberated there to the cells of the structures in which they end, where the nerve energy becomes usually converted into motive energy, called muscular movement.

Now the nerves which go *to* the brain are called the afferent (*ad*, to, and *fero*, I carry) or sometimes the sensory nerves, since they are the receivers and transmitters of sensations; those that come *from* it are called the efferent (*e*, from, and *fero*, I carry) or motor nerves, because by their assistance motion is produced. But all afferent nerves do not receive the same form of sensation in their end-bulbs. Those of the eye, for example, receive light-energy and take cognizance of colour, form, outline, etc., all of which result from light-energy; those of the ear receive air-vibration energy only; those of the skin, the energy of elasticity, which includes all the impressions derived from touch and contact. Each set of nerves, those of the ear, eye, tongue, nose, skin, and so on, according as they are capable of taking up various energies, transmit these impressions or energies to the brain, and each set possesses a special department in that storehouse in which to lodge its energy. Not that each division is absolutely cut off from each and all the others, for there is a form of connection by which they can communicate and form infinite varieties of compound sensations. Thus is produced what we know as an *association of ideas*, or thought.

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* Nerve-energy is a *form* of electrical energy—of that there can be no doubt; but at the same time it does not consist of a *simple* electric current as we know it.

In the second chapter I have said, that, as regards his nervous system, the country or individual called man should be regarded as under a dual government—an intellectual and an automatic one. Now the brain is the seat of the intellectual government; but as it sometimes sleeps, it becomes necessary that some arrangement shall be made for necessary movements—those of the heart and lungs, for example—which must go on during sleep. This is effected by the following means. In the spinal cord are situated what are called nerve-centres, branch offices, where, if the impression be not strong, the nerve-current travelling to the brain is arrested, and *at once* transferred to an efferent nerve. There is here no storage; no need for it. This is the nervous system of most of the lower animals. They are, in reality, automata, and go through certain actions in response to certain stimulations. They evidently do not possess memory, for they do not *profit by experience.* Of course I am now speaking of animals low in the scale; not of mammals or insects, for these possess a nervous system similar in structure and function, and differing only *in size and differentiation*, *i.e.*, in storage power, from that of man. Thus, to prevent, as it were, the brain being affected by *every* impression, the ordinary sensations necessary to the working of the animal machine are usually arrested at a nerve-centre in the spinal cord or even before they reach that part. Some, if strong enough to pass the first nerve-centre, are arrested at, and dealt with, by a second nerve-centre in that flattened upper part of the spinal cord, called the medulla; if so powerful as to pass this, they go directly to the brain, and are there either wholly stored up or, more commonly, partly sent back by an efferent nerve and partly stored. I will endeavour to give a practical illustration:—

A pin is thrust into a man's leg; the end-bulb receives the sensation, sends it to centre No. 1; here part is sent back as motion, for the man pricked draws up his leg involuntarily; but the impression being strong, the sensation travels past centre No. 1, and reaches centre No. 2; here it produces more general muscular movements, those of the arm and leg and those of the organs of voice, for example; but the impression being too strong to remain here, some travels on to the brain, to be kept there as memory, and to be set free, say a month afterwards, by the impressions produced on the nerves of the eye by the sight of the aggressor in the street. The stored energy may now be evolved as motor energy, and the man may be pursued by the pricked and injured party; or the stored energy may, by virtue of its power of communication with other brain-stores, collect a general impression, or an association of ideas, and may, what we call, "come to a conclusion," which may be that the aggressor is a regular practical joker and a public nuisance; or both phenomena of motion and thought may be produced.

To sum up: man is regulated in all his movements by the effects of the action on himself of the energies of nature with which he comes in contact. These energies he can, by the agency of a mechanism called the nervous system, receive, convert to nerve-energy, and transmit to his brain, which again either stores them in separate departments, and then, when stimulated by fresh impressions, but never of itself, emits them as motive energy, or partly stores and partly emits them at the time of their reception. The brain emits its energies by means of a special set of nerves, called efferent or motor, which are distributed over the body. In addition to, but connected with, and subsidiary to, the brain, are various nerve-centres which are capable of receiving and returning the nerve-current, when that current is not of unusual strength; these are called *reflex* centres, and their seat is generally in the spinal cord.

Having explained thus the self-regulation of our machine, we now come face to face with the greatest problem of all, namely, the self-construction of it. So important are the bearings of this matter on the questions of health and disease, that we must, in spite of the abstruseness of the subject, endeavour to master at least some of the great principles on which it rests.

First of all, I shall take the series of phenomena of self-construction in the order in which we observe them. Man springs from one single cell, called an ovum, which measures about 120th inch in diameter; but small and humble as is this beginning, it is probably more than he can rightly lay claim to, for within this ovum is yet a more minute body, only about 1000th of an inch in diameter, called the germinal vesicle, and it is from this vesicle that his subsequent structure is formed, the rest of the contents of the ovum acting as nourishment to the germinal vesicle in the course of the first week or so of life. Life commences, I must here explain, *at conception*, not at birth. The latter is the commencement of that stage in life called independent existence. Examined microscopically or chemically, there is nothing remarkable about the human ovum. Under the microscope it has the same appearance as protoplasm in general. In the hands of the chemist it can be made to evolve carbon, hydrogen, oxygen, nitrogen, and a trace of sulphur. That it is like other nitrogenous compounds, gunpowder, nitro-glycerine and dynamite, a storehouse of enormous energies, which can be evolved only under certain conditions, we know; but we know nothing further. We again know that the latent energies of explosives do not depend on their size, but on *the compositions and relative position of their molecules*, and the result which we obtain from the liberation of these energies depends again, not on the size of the material, but on its *rate* of explosion. This consideration lessens our astonishment at the small size of the ovum; and indeed I may say here, in passing, that size, being entirely a subjective idea, has no definite meaning when applied to nature at large. In all our efforts at discovering the secrets of nature we must, therefore, never allow ourselves to be baffled or alarmed by such expressions as size, space, or time, all being mere human measurements, the results of an unconscious comparison on the part of man himself with his ordinary surroundings and conditions.

And what can be said in regard to the *composition* of the molecules in the protoplasm of the ovum, or indeed of the *structure* of the germinal vesicle itself?—for the microscope is bringing to light the fact that protoplasm is not structureless, as was once supposed. It is on the answering of these two questions that the solution of the great problem of life rests. I say life, meaning life in general, for the meanest plant and the most plant-like animal spring, equally with man, from protoplasm.

The ovum, or rather the germinal vesicle, from which man springs is a compound of the elements, oxygen, hydrogen, carbon and nitrogen (with a small amount of sulphur). Now the chemical affinities of nitrogen are few and feeble, and hence, as with our familiar explosives whose special properties depend on this element, bodies possessing it are prone to undergo frequent and rapid changes in their constitution, accompanied, as a necessity, by the production of energy. We know, practically, from observations on explosives, that as regards the *rate* of the explosion, and the *energy produced thereby*, everything depends on the relationship of the nitrogen to the other elements present. With nitro-glycerine the explosion is sudden, and the energy evolved enormous, but very limited in its effect; with gunpowder, on the other hand, explosion is more difficult to bring about, much slower, and hence, in its effects, much more extensive. We know also that in the explosion of gunpowder the energy evolved may take the form of any of the energies of nature, and that the form or forms it takes depends on its surroundings: fired as a charge in a gun, it produces all known forms of energy at once, with the possible exception of electricity; and we are, I think, justified therefore in concluding that what is sometimes called vital energy in the ovum is really potential or latent energy, which is set free by its contact with, and absorption of, the male germ at the moment of conception, and it is upon the very slow and *gradual* conversion of this potential energy into other forms, that the phenomena known as the building up, or rather the growing, of the structure which we call man, depends. My definition, like that of all subjects about which we are not very certain, is perhaps somewhat vague; but it will serve, at any rate, as my meaning of the term latent or vital energy, when I apply it, as I shall have to do frequently, in future pages.

If my view regarding this energy be accepted, it will follow that this latent energy which is being converted into other energies resulting in the formation of fresh compounds, or, vulgarly speaking, in building, will, like all other forms of released energy, be strongest at the beginning, and will gradually wane with time, until at last it becomes completely exhausted. This is precisely what we witness: the ovum doubles its size in about two days; in three or four more it has doubled again, and so on, the intervals between the doubling of size always increasing until there is no further increase; then a decrease ensues, which gradually ends in the exhaustion of the energy, and what was before an organized or living structure becomes an inorganic or lifeless one.

Watch a football impelled by the kick of a skilful player. It ascends in the air *apparently with increasing* force; we know, however, that its greatest energy was present at *the moment of its rising*, and that with each inch it rises, it is losing to the energy of gravity, and the energy of friction, its own force,and that, before long, these two opposing forces will overbalance the failing energy derived from the kick, and the ball, in consequence, will come to the ground. It is precisely so with each one of us: the effect of the male germ is to start the ovum; it, no more than the foot of the player, can help the ball, or assist the ovum after the moment of contact. The flight of the ball, like the subsequent course of the ovum, depends on the strength of the kicker, the shape and composition of the ball, and the opposition it meets to its flight.

To sum up, we may say, that man is a machine, constructed by the action of chemical energy on the nitrogenous material which he consumes, and which he finds at first in the maternal blood, and later on in his surroundings, this chemical energy being the result, and the exact equivalent of, potential energy in an ovum, liberated by contact with a male germ. Consequently on the amount of this potential energy, and on the perfection of the ovum and the germ, depend, other things being equal, the duration and perfection of man's life. The machine is *worked* by means of heat, supplied by the combustible articles which he consumes by means of the oxygen in his blood. It is *repaired* by a similar process. It is *regulated* and *guided* by means of a delicate mechanism, called the nervous system, which takes up and converts to nerve power the energies existent in its environment.

Can we wonder that, reflecting on such subjects, a mind of the first order may be driven to commit, as did Harriet Martineau, the following conclusions, to print. "Instinct, passion, thought, &c., are effects of organized substances. All causes are material causes. In material conditions I find the origin of all religions, all philosophies, all opinions, all virtues, all spiritual conditions and influences, in the same manner that I find the origin of all diseases and of all insanities in material conditions and causes. I am what I am—a creature of necessity. I claim neither merit nor demerit. I feel that I am as completely the result of my nature, and compelled to do what I do, as the needle to point to the north, or the puppet to move according as the string is pulled. I cannot alter my will, or be other than what I am; and cannot deserve either reward or punishment."

The way I regard a further view of the question is this. Granting that man be strictly material, a species of compound stalactite that grows from an inherent chemical power of taking to its own construction a part of the elements with whichit comes in contact, whose movements, thought, will, etc., all dependent on molecular movements, are all the *necessary* result of known chemical laws; granting, further, that by the aid of any of his senses man is unable to come in contact with anything that is not material, and not subject to well-known physical laws;—conceding all the foregoing points, we may put the proposition simply thus:—Man, being material, cannot by the aid of his senses know the spiritual, if a spiritual exist. But the same powers of reasoning that have led man to unravel the secrets of his material structure and its workings have demonstrated to him the existence of certain fixed *laws*. Now a law is neither matter nor is it energy, to one of which two divisions everything of which a man has *direct* cognisance by the aid of his senses belongs, and is therefore a supersensual phenomenom. Moreover, a law without an Intelligence to make it, and a Power to maintain its action, is absolutely inconceivable by us. And such Power and Intelligence must hence have cognisance of, since it must directly concern itself with, every particle of matter, from the atoms to the spheres which we call suns and stars. Man is conceded to be the most complicated of all known material structures—that in which therefore Law has, if I may so express it, its highest development, and therefore the Power and intelligence which have made and maintain Law exhibit in him, compared with other material, their *fullest* known power. Such a view places man, as the object of a super-sensual manifestation called *Law*, higher than any known material, and, practically, nothing more than this has ever been claimed for him.

Thus we have, on the one hand, an Intelligence behind certain laws, and, on the other, the structure, man, in which the Intelligence most of all manifests its power, I can fittingly conclude this chapter with Tennyson's well-known lines :—

> "God is law, say the wise, O soul, and let us rejoice ;
> For if He thunder by law, the thunder is yet His voice.
> Speak to Him, then, for He hears, and spirit with spirit may meet.
> Closer is He than breathing, and nearer than hands and feet."

CHAPTER IV.

MAN IN HIS DEPARTURES FROM HEALTH OR EQUILIBRIUM.

THIS chapter, which is a most important one, will almost naturally divide itself into three parts—viz., a short *résumé* of man in an ideal state—one of moving equilibrium or perfect health; a plan of the roads which lead to digressions therefrom, and a consideration of the means at his disposal wherewith to restore his equilibrium. Man is a machine worked by a potential energy, which, released at the moment and by the act of conception, determines by its amount, other things being equal, the standard of health and the duration of life of the individual. To return to our simile of a football: the distance the ball will travel will depend on the strength and kind of kick and the adaptability of the ball for flying, the conditions of wind, &c., being always equal. But the human ball, the ovum, has not only to *fly*; it has to *grow*; in other words, it has to turn much of its potential energy into the chemical energy whereby it can build from its surroundings. Thus, it follows that the potential energy with which man begins life has to be divided into flight, or duration of life, and chemical energy, or building.

If we grant the preceeding propositions, we must, of course, see that both duration of life and perfection of building will depend on the original store of potential energy, this again depending on the structure of the female ovum and the male germ, these, in their turn, depending on the individuals who produced them. Now the energy in all projectiles, in our football, for example, is of course greatest at the commencement of its flight, and according as it is converted into the opposing force to its flight—gravity and the friction of air—becomes less. For example, I stand at the bottom of a mound and kick a football, so as to be clear of the ground, upwards in the direction of the top of the mound, with force just sufficient to clear its apex, and if a boy stand on that apex,* he can, with the utmost ease, arrest the course of the ball since the energy it derived from the kick is all but expended ; but let the same boy stand but three or four yards away from the place of kicking, and let the power imparted to the ball be the same, and he will find it difficult by opposing his whole weight to arrest its flight, and, even if this be arrested, the rebound will bear evidence to the strength of the force with which it struck him. This is, of course, so very simple and intelligible that no one will dispute it. Let us apply the same method to our potential energy in the ovum ; its powers of opposition to resistance will be great in the commencement of its flight (life), will be but moderate in mid-flight, will be almost *nil*—for it will not be assisted by gravity, as a falling ball would—towards the end.

Such is precisely the course of the human body. In infancy and youth, decay, all conditions being equal, rarely attacks it ; for, unless the ovum has been singularly imperfect, its powers of resistance at that time are very strong ; in middle life, especially if youth has been spent in what is most appropriately called a *fast* manner, or if, as not unfrequently happens, the ovum has been but moderately perfect, decay is apt to manifest itself ; in old age decay is always present, though not to an extent which renders life impossible, nor, if the original energy has been strong and wisely expended, to the extent which renders life unendurable ; since the decay is then general, and, as a necessary consequence of that, the sensation attendant on it is proportionately dulled.†

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[*] We cannot here take the falling of a ball at the time it is close to the ground, for then the force of gravity has to be added ; we must, to avoid this, take it in mid-flight.

[†] *Decay* must not here be confounded with *derangement*, the former being a process of slow, sure death ; the latter an elastic recoil, usually, as regards life, of a beneficial [illegible] ;

Let us now define the term, health. Health is that condition and state of the body in which it can perform work, suited to the repairing power and the structure of the mechanism, with the least possible resistance from opposing forces in nature. It may therefore be called the *equilibrium of the body.* The *standard* of health of necessity varies: what in a strong, robust man is wholesome work, would in the puny, scrofulous one involve severe strain, telling disastrously on his duration of life. What is healthy and necessary work for the youth at twenty would be a dangerous and even fatal amount for an aged man.

I shall, in future pages, speak of health as equilibrium, for the use of the word, better than that of any other, implies the *state of balance* in which a man stands to his surroundings in what is usually called health. It is especially important to be clear on the question of the healthy standard. One frequently meets a man, say of middle life, well filled out, with plenty of colour in his cheeks. He tells us that his father suffered from rheumatism or gout, and died of bronchitis at fifty-five years of age, and that his mother died at about the same period of some unknown disease. The patient himself is what he calls a *good liver*, that is, he partakes of three or four meals a day, at two or three of which he eats meat, and he drinks from one to two pints of beer and a couple of glasses of spirits, on an average, in the same period. His muscular power is fairly good, but his breathing power becomes deficient on exertion. His occupation is that of a shopkeeper. He takes liitle exercise: he sleeps well; his exact weight is fifteen and a half stone; his height, five feet, ten inches. He considers himself in first-rate health.

Now, if we make a careful analysis of our friend's state, we shall arrive at a very different conclusion to his. Here is a man whose father died of bronchitis at a premature age, and who, for years prior to his death, suffered from some affection of the joints, almost for a certainty, gout. In other words, he was *so full* of gout, that it killed him fifteen or twenty years before he should otherwise have died. His mother also died at about the same time, as a result almost certainly of some premature degeneration. The family history is therefore bad, and our friend is doing his best to make the personal one correspond. He is con suming meat (nitrogenous food) far in excess of his need for repair-material (the main object of nitrogenous food being to repair protoplasm); in fact, he is eating almost more than is required, for a youth of fourteen or fifteen years, who has yet a great deal of growing to do. Fuel-foods are also being consumed in excess of his needs, as witness the deposits of fat all over his body, which is far beyond the small supply of reserve fat necessary in health. This accumulation is already hampering his respiratory muscles and his heart, not to mention his other muscular structures, and will before long become such a source of danger to him, and so impossible to remove by any cutting down of diet short of semi-starvation—and a diet such as that he will no longer have the power to stand—that it alone will certainly take off ten years of, what may be called, his normal term of living. And how about the probability of any gouty or rheumatic tendency in him. The nitrogenous foods are notoriously difficult, when taken in excess, for even a young and strong liver to digest, and the kidneys require also to be in a very high state of functional activity to get rid of the resulting urea and uric acid, when these substances are constantly present in excessive quantities. His muscular system is, from want of exercise, not doing the duties of pumping up waste material, which, as we shall see later on, is one of its main functions. And to crown all, he is hampering his whole system with alcohol.

Such a man is really leading the life of a fool, and, unless he reform his whole system of living, must soon begin to feel the pangs of premature decay. He is rapidly exhausting the energies in his liver and kidneys; he is clogging the machinery recklessly with waste material. His blood supply is so defective, that it it may be doubted if it contain the supply of oxygen sufficient to consume necessary fuel-food, and certainly the rate at which this is being packed away, as fat, favours the belief. Such an individual is commonly met with. He flatters himself that he is a typical Englishman, and that such men as himself have stood, in times long past, as a bulwark between his country and destruction. Vain delusion!—it was the Scotch, Irish, and English peasant, whose manhood and early years had been spent in hard work in the open air, with simple, scanty, but sufficient food, which in the majority of cases was almost entirely vegetarian in its character, who saved England. A couple of nights in the trenches would cripple for life, with that latent gout or rheumatism, ripe to manifest itself on the slightest provocation, our fat friend, if the exposure itself did not previously carry him off with pneumonia, as it very probably would.

No; such a man is not a specimen of health. He may possess pluck and spirit, and be able to make a very good show in a pot-house brawl; but his blood is full of gout and rheumatic poison, *i.e.*, uric acid, the result of his nitrogenous diet, and it is only by the utmost exertion that his skin and kidneys are able at all to cope with its excretion; cold and damp, in short, anything that can check the function of either of those organs, will precipitate an acute attack of one or the other of those complaints. I have given the foregoing as a specimen of what is *apparent* health, but which, in reality, is the reverse of it.

Having defined health as equilibrium, let us now consider the roads which lead to digressions therefrom. All loss of the equilibrium of health is due to one of four causes. (1st) DEGENERATION or premature slow death of one or more organs of the body. This is usually the result of defective structure of, and, as a sequence, defective energy in, the ovum (*i.e.* due to congenital *taint*, so called). Sometimes it is the result of early exhaustion of one or more of the bodily organs from systematic mismanagement; most commonly, the combined result of both these factors. (2) TEMPORARY FUNCTIONAL DERANGEMENTS, always of a beneficial nature, and due to the presence of *elasticity* which the human body shares with *all* material substances, and by virtue of which it and all bodies, after collision *with opposing forces*, tend to regain their original shape and form. (3) WANT OF FOOD, and hence of motive power and structure and repair material, or want of salts. (4) NEW GROWTHS, *i.e.*, tumours.

I particularly wish to draw the reader's attention to the above classification, believing that in the comprehension of the essential and absolute differences which exist between classes 1 and 2 lies the satisfactory solution of those apparent differences of opinion as to treatment held by various schools of medicine.

CLASS I.—PREMATURE DEGENERATION OF ORGANS, OR DECAY. This is always an evil, and always irremediable as regards the damage done. Good, great good, may be effected, however, in the individuals who are the subjects of it, by teaching them to economise the vitality, *i.e.*, the store of vital energy, still remaining in the degenerated organ. Let us illustrate the subject by one or two examples of premature degeneration. Our first example shall be the common disease known as scrofula.

In infancy, the lymphatic glandular system is the most active of all the organs of the body, and scrofula, therefore, makes itself at that period of life most conspicuous in that department. In the glands of the neck, as being those most easily seen, the tale is eloquently told ; but those of the abdomen, the lung, and of all the other parts of the body, are, though not visibly, equally the subject of enlargement. If the scrofula be of a mild type, the glandular mischief will not always be in evidence, but a very trifling exposure to damp, or other unfavourable circumstance, will readily bring it out.

In adolescence and early manhood the lungs become exceedingly active, and therefore scrofula, in the disguise of consumption, then most frequently attacks those organs.

In middle life, a change of venue occurs, mainly to the bones, which, on small provocation, are apt to necrose or die. Old age is not often reached ; probably never by those in whom the taint is very strong.

The above description must be understood as having the value of but a brief generalisation. Necrosis may occur in infancy, consumption in advanced life, and both be clearly due to scrofula ; but I have placed briefly before the reader the most common sequence of events.

Let us now devote a few lines to those diseases which spring from an ovum of much greater perfection than the scrofulous one. Gout, rheumatism, the neuroses (*i.e.*, the group of nervous diseases), and most probably the cancers, belong to this division. The subjects of these taints are not born cripples, and doomed to run the race of life on crutches, as are the subjects of scrofula, but they are "bad stayers." They look very well at the start, but in the middle of the race begin to show signs of distress, and are "nowhere" at the finish. As gout has much to do with food and the various dyspepsiæ, being itself a dyspepsia, we will select it for description as a type of this class.

The subject of gout generally proceeds through infancy and youth with so few evidences of his hereditary taint as to deceive himself and his friends, and all but the most observant of physicians. He may, in fact, during those periods enjoy a fair share of health, when suddenly, at from thirty to forty-five, quite unexpectedly to him, his liver breaks down, and can no longer deal efficiently with the nitrogenous food it receives. Instead of allowing, as later on we shall see it is its function to do, some of this in the form of serum-albumen to pass on, arresting some for the purposes of forming bile-acids, storing some as glycogen, and sending off the waste as urea to be got rid of easily by the kidneys, it fails in the latter part of its duty, and begins to form a lower product than urea, namely, uric acid, and turns that loose in the blood. Now the kidneys of birds and reptiles can deal with uric acid perfectly, and, in fact, this forms the main constituent of their *solid* urine; but with man it is altogether different. No sooner is the uric acid in the blood than, in obedience to a chemical law, it seeks for an alkali wherewith to form a salt. Now the alkali which is most prominent by its presence in the blood is chloride of sodium, and forthwith the uric acid unites with the alkali and forms urate of sodium. This salt, unlike the urea which it replaces, and which is very soluble, requires eight thousand times its weight of water for perfect solution, and the powers which the kidneys possess of dealing with it being limited, it collects in the blood, and when this fluid possesses no longer sufficient watery fluid to hold it in solution, it becomes deposited in sharp crystals, which show a preference for certain parts of the body where the circulation is least strong, *e.g.*; certain portions of the joints, and especially for those joints, such as that of the great toe, which are, as a result of the constant pressure of boots on them, least healthy, *i.e.*, least supplied with a good blood-stream. Such is a brief sketch of the course of events.

Now if our gouty man persist in his wrong-headedness, eat and drink more than his liver can deal with, and will not follow hygienic rules, the gouty attacks will become more and more frequent, and his kidneys, as a result of the extra strain thrown on them by the efforts made to excrete urate of sodium, will gradually become diseased, and he will die prematurely from blood-poisoning, owing to the failure of these latter excretory organs, which will become affected by a form of degeneration which has well received the name of gouty Bright's disease. It is very important to remember one useful fact, which careful observation is tending every day to convert into an absolute law, namely, that all our familiar diseases, gout, rheumatism, bronchitis, pneumonia, pleurisy, asthma, bone-disease, insanity, epilepsy, in short, inflammations and degenerations of all species and kind, never attack a *healthy* individual, but are the duly proportioned result of disease already existent in the individual, and have been *developed*, *never produced*, by some slight strain on his system, such as could not injure a sound individual.

One final word on the question of degenerations. I have made no mention of those which are the result of old age, and that simply because they are dependent on that alone, and are thus perfectly natural phenomena quite unconnected with disease.

Let us now pass to the treatment of these degenerations. All treatment of disease is of two kinds—*hygienic*, and what I may call, for want of a better term, *scientific*, which latter term may be held to mean the assistance given to the laws and conditions of equilibrium by the intelligent use of scientific knowledge.

Hygienic Treatment :—Now, in degeneration, we have to do with an inherently imperfect structure. It is of no use fostering the wrong impression that we can make it perfect ; we must accept it as it is, and endeavour to make the best of it. The main object of medical science is to *prolong life*. That is ever the physician's great aim. It is not for him to ask if the life before him be worth preserving or prolonging. In addressing the subject of scrofula, he speaks, therefore, in an imaginary way, as follows :— "You have an imperfect structure and an imperfect supply of vital energy. The one is the consequence of and dependent on the other. Now my aim must be to make the little you have last as long as possible, and, to that end, you must place yourself in such a position as to secure the maximum of conditions favourable to your life, and to encounter a minimum of those forces of nature which are deleterious to you, especially those which act upon what happens, owing to your time of life, to be the weakest part in your system. You are for example, young and scrufulous. Your blood is poor, for half your lymphatic or blood-forming glands are out of gear; you cannot increase in weight as you should do at your age, for this poverty of blood has led to nerve-starvation, and this again to failure of digestive processes, and you cannot obtain the good from food that you should do. You must henceforth live at the seaside or in the country, where there is plenty of a substance called ozone in the air, which, consisting of three atoms of oxygen, is an unstable compound, and will give you up the third atom. In that manner you will put plenty of oxygen in your blood-current, which will bring with it a natural demand for food, and, more than that, when you supply the demand, the oxygen will speedily enough burn up the fuel food, and supply you in its place with the energy and power which you lack. The oxygen will do much the same for your structure-forming foods. Nearly all your other complaints and disorders are secondary, and will improve of their own accord when you are able to eat and *thoroughly* digest food."

Or, again, addressing a gouty, high-living, middle-aged patient:—"Your liver is out of sorts in that part of its function which has to do with the digestion of nitrogenous foods. I must calculate the minimum amount of nitrogenous food that you require, and then I can furnish you with a practical dietary suitable to your case. In the meantime you have too little water in your blood, the urate of sodum is being deposited in your joints: drink two quarts of hot water a day. As you are, furthermore, clogged up, looking on you as a machine, you will do well to take a good aperient. Something to stimulate your kidneys to act will also help to avert the threatening mischief from the collection of urate of sodium in your blood. Exercise will, by setting your muscles in action, pump some of the waste out of your system, and it will set the excretory apparatus of your skin to work. Moderate your supply of fuel-foods: you are laying up too much fat and straining the whole machinery of the body by the excessive production of heat-energy."

So much for the hygienic portion of the treatment. Now for the scientific.

"Science can do little for you, the scrofulous patient. There are various shibboleths, it is true—hypophosphites, pre-digested foods, etc.—but they are mere wills-o'-the-wisp. As for the pre-digested foods, learn, once for all, that a demand for food and a power of assimilating it proceed *pari passu* in the human body. In his pre-digested food the chemist has very skilfully circumvented the failure of digestion, as far as the stomach and bowels are concerned, but he cannot get round the difficulties of assimilation; he may succeed in getting the fuel into the furnace, but if the engine be out of order, and the draught of air insufficient, he will not get it to burn or to evolve energy. Put your trust therefore only in hygienic means. Real science cannot aid you,—beware, lest a simulacrum of it create for you a fool's paradise in which you will be tempted to linger till all hope of recovery is gone."

"For you, the gouty patient, I can do something in the scientific line. I know that the urates of lithium and potassium are more soluble than that of sodium, and I can prove that potassium and lithium salts are capable of finding their way, when administered by the mouth, into your blood-current. I therefore order you those salts in certain amounts, and can promise you that they will effect good."

Such is a short sketch of the origin, course, and treatment of two common degenerations. We now come to the consideration of perhaps the most important of all the deviations from equilibrium of which the human body is susceptible, namely those arising from—

CLASS 2:—TEMPORARY FUNCTIONAL DERANGEMENT ATTENDED BY PHENOMENA DUE TO THE PROPERTY OF ELASTICITY PRESENT IN THE HUMAN BODY—A PROCESS BY WHICH EVERY PORTION OF THE BODY TENDS WITHIN CERTAIN LIMITS TO RECOVER

ITS ORIGINAL SHAPE AND FORM AFTER CONTACT WITH OPPOSING FORCES.

No absolute line can perhaps be drawn between this class of causes and those mentioned under the head of "Degeneration," for it may be urged that the constant functional derangement of an organ will in the end lead to its degeneration, and such is undoubledly the case; and this arises from the fact that not only do all bodies possess elasticity, but, furthermore, that no solid body possesses it to the perfect amount. The elasticity of a billiard ball, for example, appears to be perfect, as it in fact nearly is, since its recovery of shape after a blow seems complete; in clay and lead, the elasticity, though present, is in such small amount, that, if we did not know that it could be proved by direct experiment to exist, we should be inclined to doubt it. Physics inform us that all gases and liquids are *perfectly* elastic; but that no solid body, not excepting ivory, possesses perfect elasticity, or, in other words, that no solid body does *completely* recover its shape after contact with an opposing force. Now we understand how it is that frequent functional derangements lead *eventually*, but only after long lapse of time, and with a rapidity dependent on the healthy tone of the tissues, to marked and noticeable change of shape, and hence to degeneration; but this concession, which, to save any possible misapprehension, I hasten to make, does not invalidate my statement of the wide difference between degenerations and functional derangements.

The human body, in which term I include each and every individual cell, possesses, in a state of health, an almost perfect elasticity, and must therefore, according to physical laws, in proportion to the strength of an opposing force, exhibit the phenomenon known as rebound, this rebound being the result of the effort to regain form. But an opposing force does not always, nor usually, act directly on the whole body, but mainly affects some one organ, that with which it comes first and most in contact; thus the functional derangements due to the rebound exhibit themselves sometimes exclusively, always most prominently, in one organ. Now this rebound, this effort to recover lost shape and equilibrium, these phenomena, which are the result of it, as seen in the human body, are commonly mistaken *for disasters*, and spoken of as illness, sickness, or maladies, to be actively combated by drugs, when their action is, and must be, distinctly beneficial. If recognised at all as beneficial, they are spoken of as evidences of a *vis medicatrix naturæ*. But all such phrases and terms, as *vis medicatrix naturæ*, margin for overwork possessed by organs, etc., are really meaningless, and tend to degrade medicine, and to lead to such expressions of opinion as that of the celebrated French physiologist, Dr. Magendie, who said, on addressing his class, "Gentlemen, medicine is a great humbug. I know it is called a science: science, indeed!—it is nothing like science." It may be said that the terms I have quoted are used as convenient equivalents for elasticity or some allied and purely physical process. It is possible that such an interpretation may be present in the minds of some who employ them, but in the vast majority of cases they are used to imply the existence of some vague force possessed exclusively by plants and animals, or by animals only, or more commonly by man alone, which benevolently interferes on behalf of the structures when they are from any cause deranged. Let us discard such terms or apply them equally to the inorganic world, and let us get rid, once for all, of all ideas about special forces and energies present in the organic which are absent in the inorganic world, and we shall then be spared the humiliation of having to cede those untenable positions which the medical profession, as opposed to real science, not unfrequently takes up.

Now the elasticity in all bodies has what is called its limit, or the point at which elasticity ceases and disintegration begins. Glass, for example, possesses a large amount of elasticity, as we see in the rebound of a glass marble from a stone slab; but it also possesses a certain limit to its elasticity, and directly that limit is reached the glass marble shatters. So it is with the human body. The opposing force may be so great or so constant as to lead to a gradual or sudden death of one or more organs of the body, and this local death will, in many cases, entail consequences leading to general disintegration of the whole body.

All fevers belong exclusively to this our second class, and though, unfortunately, the germs which produce them are possessed sometimes of such force as to pass the limits of elasticity in the human body, and to cause death, yet all the so-called derangements they produce, their symptoms, are exclusively and entirely of a beneficial nature, and very frequently, indeed, are the sole cause of recovery. In the term fevers I would here include all those diseases which are probably the result of a bacterium or vegetable ferment; and, therefore, besides scarlet fever, typhoid, measles, typhus and small pox, my definition must be held to extend to many others, which always in a medical, though not in a popular sense, are reckoned amongst the fevers; examples of such are erysipelas, pyæmia or wound-fever, puerperal septicæmia or lying-in fever, diphtheria, cholera, ague, famine-fever, etc.

I shall graphically run over the symptoms of a disease of this class, viz., scarlet fever.

(*a*) *Period of incubation.*—The patient contracts the fever; in other words, the bacterium of scarlet fever gets into his stomach, some think into the lungs; but the power of the air-cells or bronchial tubes to absorb anything of the nature of a bacterium is exceedingly doubtful, and the special bacterium of consumption itself, if there be one, probably gains access to the body by what is called the alimentary tract—the mouth, stomach, and bowel. Once having reached the stomach, it multiplies and probably many of its progeny find their way into the bowel. At any rate, a consideration of the symptoms seen during this stage points to the great probability that the first series of rebounds against the action of this foreign force, in the person of a bacterium and his offspring, takes place in the stomach and bowel. This period may last from two or three up to ten days, the patient merely showing a disinclination for food and some lack of energy resulting from such want of nourishment and from the concurrent interference with the digestive process; but, to an observant eye, each day matters look more gloomy, and the mother, if the patient be a child, expresses an opinion that the little one is "sickening for something." The bacterial army is increasing, and the limits of elasticity on the part of the cells lining the stomach and bowels are at last reached.* Then commences—

(*b*) *The second stage.*—This was very aptly named, long before the existence of bacteria were known, the *period of invasion.* The bacteria swarm into the portal vein, which carries them swiftly to the liver. Here they encounter a most powerful fort which guards the citadel. The attack on and the rebound from the cells of the liver are severe, and produce that bilious vomiting which is such a well-marked symptom at this stage. The older medical observers laid down the rule that the more severe this vomiting, the worse was the attack likely to be; and modern observation, as indeed, if my account be correct, we should expect, has amply confirmed this opinion. The resistance of the liver is sharp, but generally short; the stronghold is carried by assault, and the victorious army rush into the citadel. This forms the commencement of the

(*c*) *Third stage.*—The army is now in the blood, and the series of rebounds produced by the action and reaction of the enemy in the various tissues are so frequent and manifold as to be difficult to enumerate, and still more to trace. We know that one of the manifestations of rebound—the appearance of a red rash—is beneficial; and we have strong reason to suppose that it is to the elastic power possessed by certain depressor-fibres in the sympathetic nerve that we owe this.†

(*d*) *Fourth stage.*—Lymphatic-gland affection. It is evident now that the opposing forces have overcome resistance in the blood, and have succeeded in penetrating to the chain of lymphatic ducts, for their glands show signs of enlargement. What is this enlargement but the effects of the resistance, due to the elasticity of their component cells, of the glands to the further passage of the enemy? The amount of gland-enlargement is here an index to the remaining power possessed by the bacteria; for we will presume that measures have been taken to prevent the possibility of *reserves* entering the stomach, and we hope that the resistance offered by the blood, &c., has been powerful enough to prevent any recruiting of their numbers by reproduction. We look at those lymphatic glands, the tonsils, and if they be much swollen, and be breaking down badly, we know that the chances of life are getting smaller. If scrofula or syphilis have already, in earlier life, weakened the lymphatic system, woe betide the sufferer!—for once past the lymphatic glands, and the bacteria will have access to the whole country, and will there find such an abundance of sustenance that they will multiply and lay it waste. But if the lymphatic glands can offer an efficient resistance, the army of bacteria will be starved, for they have assuredly eaten all behind them.

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* It is probable that the paralysis of the nerves going to the blood-vessels and cells in the alimentary tract, which occurs at this period, leads to the attacks of shivering—a well-marked precursory nervous symptom, always followed by a rise in the fever, and indicating by an extension of the mischief.

† The whole question of which fibres in the sympathetic system cause dilatation and which cause contraction of the small blood-vessels is still *sub judice*, and it is more than possible that I may be wrong in selecting the depressor nerves as the ones which produce the rash; the *principle*, however, is the same, and that is what I wish to emphasise.

Such is a brief description of a bacterial attack. Of course, all bacteria are not alike either in structure or power, though they probably all, even that of diphtheria, enter the system by way of the stomach and bowel, which are, by the way, the only parts endowed with any high absorptive power. Some bacteria, such as those of cholera, are so powerful as almost for a certainty, unless very promptly attacked and killed, to overcome the resistance of the bowel and stomach, manifested as these are by the premonitory diarrhœa, and to pass the liver, which they greatly derange, as we know, and enter the blood. In the worst cases of cholera, that is, in cases where the bacterium is best developed and most potent for mischief, the rebound of the tissues is scarcely marked, their limit of elasticity being almost instantly passed, as when an iron hammer striking a glass ball shatters it at once. Still there is consolation in the undoubted fact that the greater the health of the tissues, the better the chance that the bacteria will be repulsed.

But let us leave the bacteria, and take a second instance of the development of elasticity in the tissues by the action on them of opposing forces.

A man partakes, say in a sausage, of meat in a state of putrefaction. A poison, technically called a ptomaine, resides in such decomposing organic matter, and, in the case in point this poison finds entrance to the patient's stomach and bowels. The effect of such an opposing force is to arouse an active development of elasticity in the cells of the digestive organs with the result that a large amount of watery fluid is poured out by them, and diarrhœa and vomiting ensue. (Sometimes, as in the case of such a poison as lead, *contraction* of the cells and their blood-vessels, with *lessened* secretion, results: this is an *early* and *slight* development of elasticity, and is followed, if the opposing force—as is a ptomaine—be very powerful, by dilatation of blood-vessels and an increased secretion of fluid. *Both* contraction and dilatation are beneficial; for while contraction largely prevents the absorption, dilatation and increased secretion tend to the expulsion of the enemy.) Now this fluid is often sufficient to wash away the ptomaine; but, if it be not, the ptomaine is absorbed into the blood and reaches, by means of the portal vein, the liver. Here it sets up a high degree of elasticity, and in nine cases out of ten, it is, by means of certain bile-tubes, which subserve also the use of waste-pipes, ejected with the bile and reaches the intestine again; but now its powers are altered, for the bile is an antiseptic, and has acted chemically on it, so that it passes as a rule, without doing further mischief, out of the body. But if the ptomaine be powerful, it may overcome the elasticity of the liver-cells and may enter the general blood-current by means of the hepatic vein. Further symptoms, similar, in many ways, to those of an epidemic fever, into a consideration which I need not again enter, then result.*

But, interesting as this subject is, I must defer its further elucidation to a future work, in which I hope to demonstrate, by experiments I am now engaged in, the truth of my observation, my object here being merely to illustrate a principle, that of elasticity, as evidencing itself in certain beneficial symptoms. I will now pass on to the question of the treatment of the symptoms which indicate the existence and action of this elastic power.

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* I may here say that the bacteria of ague seem to reach the liver, be rejected with the bile, but *unaffected* by this fluid, to be again and again re-absorbeed by the bowel, and reach and attack the liver, producing this *periodic* attack with which we are familiar in that complaint. Hence the benefits which often result in ague from the use of purgatives and emetics.

Hygienic Treatment.—Keep the body in as perfect a state of health as possible, and then few dangerous bacteria, if indeed any in a temperate climate like that of this country, can ever pass through the walls of the stomach and bowels, or will speedily die if they do gain access. This is the only *preventive* known. It is the only one which doctors themselves use when they have to encounter bacteria. Avoid, also, of course, contact with dangerous bacteria as far as possible. There is an old and true saying, that it is "better to run away from the devil than to stay and fight him," which, however sure we may be of our own strength to resist, applies equally to the bacterial enemy.

Scientific Treatment.—When bacteria are present in the stomach or bowels, assist the elastic resistance of the cells there. This I believe can be done by certain drugs. Acids have a high power of preventing absoption by the walls of the stomach and bowel, as many an individual who has systematically drunk acetic acid, in the form of vinegar, knows by the loss of flesh which has been the result of this diminished power of absorption. Sulphuric acid, taken in very small and dilute quantities (15 to 60 drops of the dilute form of the acid in half a tumbler of pure water) has the most marked effect, however, and prevents most effectually in many cases of bacterial poisoning, in English cholera, for example, further absorption of the mischief. Opium is another drug with a similar, but more complex, action. Now, how do such drugs act? Mainly by increasing the elasticity of the cells. In other words, they lead to a rapid contraction of both the cells and their tiny blood-vessels, *i.e.*, to a change of form and consistence, which includes a change in elastic power. It is an indisputable and easily demonstrable fact, that the addition of liquids or solids to any substance alters, either by increasing or diminishing its elastic powers. This theory which I here advance, that the resisting power in the body is due to elasticity, may seem at first sight a remarkable doctrine; for people are accustomed to regard any living substance as outside the jurisdiction of physical laws, whereas every form of matter is subservient to them, and every form of matter is possessed of elasticity.

Finally, the beneficial process that is going on should be favoured and imitated. A drug should be given that will produce symptoms similar to those in process; never one that there is reason to believe has an *opposite* effect. This is, in fact, a necessary corollary of my proposition. We shall not as a rule succeed in finding any drug, or any group of drugs, by means of which we shall be able to imitate and facilitate *all* the beneficial processes which are present even in the simplest case of functional derangement, but we must do the best we can with the means at our command. Such treatment has for long been recognised *empirically*: thus Hippocrates recommended mandrake in mania; Trousseau, that a child, in whom the rash of measles did not manifest itself well, should be for a few seconds brushed over with stinging-nettles, or laid in nettles. Heat is universally recommended to the inflamed joint in gout in imitation of that process by which, in raising the temperature of the joint, nature herself burns the surplus uric acid in the blood; castor oil, again, is quite a popular medicine in diarrhœa, and Dr. Barr, of Glasgow, has recently recommended quinine in the case of certain subjective sound, such as ringing or beating in the ears. I might pursue, almost *ad infinitum*, the list of cases in which this principle of treatment finds expression. Though sanctioned thus by long usage, I have found in no book that I have ever read, and have heard in no conversation that I have ever had with any one, lay or medical, aught of any principle and rule whereby the *rationale* of the beneficial action of drugs, which produce the same symptoms as those which we wish to alleviate might be explained.

But I may seem to be adopting as my own, and novel, the whole homœopathic principle. I believe—I am open to correction on the point—that the essentials of homœopathic teaching are—first, that all, or almost all, diseases and degenerations may be treated and cured by drugs, which is what I emphatically deny; secondly, that a dose, usually infinitesimal in amount, of a drug that produces symptoms similar to the disease which it is desired to treat should be administered—a statement which I cannot accept unless we eliminate from our definition of disease many forms of derangement now included in it; thirdly, that the principle of *similia similibus curantur* is to be regarded as a species of *essential truth*, almost too sacred to be tried in the furnace of controversy and experiment, and that this principle is, further, of almost universal application, neither of which positions can I grant. But, as against this, I think that there is, in homœopathy a germ of truth which has not as yet received due recognition.

But while, if I may be permitted to make a confession of faith, I am no homœopathist, and should be sorry to bind myself to any school of treatment, and consider myself free, in fact bound by conscience, to practise and, if necessary, to proclaim what I consider to be the truth in matters of medicine, I very willingly would concede an equal freedom to others, and have nothing but contempt for that jealous and commercial spirit, alien to all true science, which would debar from the right hand of fellowship, should he seek it, any qualified man who honestly believed, uprightly practised, and was willing to defend before impartial and competent judges, any medical theory or special line of treatment. In Great Britain and Ireland every man has, at the present day, before qualification, to show that he possesses a good knowledge of the great known *truths* which form the groundwork of both medicine and surgery. The best way of subsequently applying those truths in practical medicine is entirely a matter of opinion, and, classing myself rather as an agnostic (*scienter nesciens*, *sapienter indoctus*) in the matter of applied medicine, I would recommend to all the application of that well-known and grand aphorism, "*In necessariis unitas*, *in non necessariis libertas*, *in omnibus caritas*."

The third class into which I divide all causes of loss of equilibrium comprises the derangements due to—

CLASS 3.—WANT OF FOODS OF SUFFICIENT AND PROPER QUANTITY.

This class again touches here and there, in certain minor points, the two preceding ones. For in gout, a food—if we consider, as I think we must, that salts are food—a salt of potassium is needed in the blood. In scrofula, another food, namely fat, is required, and capable, if digested, of effecting some improvement, and so on in many diseases. In fact, with the unique exception of scurvy, I do not know of any disease which is due simply and exclusively to want of food. Starvation itself, perhaps, scarcely comes under the head of disease, though it has been very truly remarked that in three-fourths of the cases of death from all causes, starvation is the real and final cause; but then such starvation is secondary to some other formidable complaint, and could not be met merely by a supply of food.

Salts of various kinds are, no doubt, very frequently wanted by our bodies, and the lack of them is responsible for some of our more mysterious diseases; but such a statement has only the value of a surmise, and would not warrant me in forming a list of such complaints. I shall perhaps be acting most wisely, if under the head of want of food I give a short list of the diseases which are known to be *largely* due to such deficiency.

In scurvy, a disease seen at the present day much more frequently amongst poor seamstresses and others who do hard work in confined rooms on an insufficient dietary, than among sailors at sea, we find a lack of certain salts which are contained in fresh vegetables and in certain fruits, more particularly in limes.

In osteomalacia, or bone-softening, and in rickets we know that phosphate of lime is wanting in the bones. Both diseases are, however, constitutional, and require a very much wider treatment than a mere supply of phosphate of lime, which, indeed, if taken, rarely or never goes to the bones at all, in fact is probably rarely absorbed.

In chlorosis, sometimes called anæmia, that complaint to which young women from fifteen to twenty-five years of age are particularly liable, and which is marked by great pallor, breathlessness, acute dyspepsia, &c., the salts of iron are evidently wanted; but though these do good, they meet a portion only of the real demand of the system.

In marasmus, as the wasting which occurs in young infants is called, we have often to do with pure starvation due to the supply of foods which are not susceptible of digestion at an early age. Scrofula, however, usually lurks behind marasmus.

I now pass to a very brief consideration of the fourth class.

CLASS 4.—DISEASES DUE TO NEW GROWTHS OR TUMOURS.

In this class we are brought face to face with phenomena that set at defiance all our preconceived notions of the regularity and order which should characterise the living body. Some tumours, the syphilitic, for example, and the various forms of abscess, boils and carbuncles, all tumours in the strict sense of the word, are, no doubt, easily enough accounted for by known laws; but why portions of bone, of fibrous tissue, of skin, &c., should suddenly, and often without apparent cause, commence to sprout and grow in a manner and direction at variance with, and opposed to, the recognised and general form of the body, is not by any means clear, though no doubt the parts from which they grow are generally those that have been subjected to unusual strain.

In medical language, all tumours are divided into the two great classes, simple and malignant; to the latter class belonging all those which tend to spread rapidly and destructively, and to reproduce themselves, by means of the blood, in distant parts of the body. The distinction between the two classes might thus seem very great, but in reality chiefly lies in the shape and size of the cells of which they are composed, the malignant being composed of very small cells which readily gain access to the blood-channels, the simple containing larger cells which cannot travel in that manner: of course, there are other points, such as difference of blood-supply, &c., but the size of the cell is the essential one. Now what about the causes of tumours in general. A recent and very ingenious theory is that they spring from small portions of embryonic tissue; in other words, that here and there in the body of persons affected by tumours there have existed cells that, like the hare in the fable, have early in life gone to sleep, and, like that hare, when she saw the tortoise at the winning post, have put forth as the result of some stimulation all their dormant powers. This view would coincide with what I have said about vital energy, such cells putting forth the store of this energy that they possess, in opposition to the general contour of the body, because the conditions under which, if it had been rightly employed at the right time, they should have developed, are now wanting. The theory, however, appears to me fantastical and far-fetched, and I incline rather to the belief that owing to some local palsy of the nervous apparatus, the result of mental distress, of shock, etc., acting on an individual prone by heredity to this form of derangement, *plus* some local stimulation, the remanent vital energy in certain cells becomes beyond control of the nervous system, and rapid proliferation of such cells in an imperfect state of development results, the crowding together of which leads often to a breakdown of the tumour, as we see in cancer.

The question of treatment is always, where the precise cause of a malady is unknown, very doubtful, and I prefer not to enter into a consideration of any *medical* view of it; surgery can, however, especially if early recourse be had to it, do much for the sufferer.

With these remarks I close the first part of this work—that which has to do with the *general* points in man's structure. In all correct modes of thoughts, as is well known, a progression from the general to the special must be made. Had I been writing for the medical profession, I should have omitted this earlier part of the book, as I should have presumed that my readers possessed a knowledge of the philosophy of man from a general standpoint. With the lay reader it is very different. Though a traveller in many lands, I have scarcely ever met with an individual, however well informed in general knowledge, or even in abstract science; who, not being a medical man, had *any* real knowledge of his structure or of its functions, or of the rational principles which govern them. For all those who wish to supply such a want I write, having ever in my mind the following lines from Schiller's manly and beautiful "Lied von der Glocke":—

> Dass ist's ja, was den Menschen zieret,
> Und dazu ward ihm der Verstand,
> Dass er im innern Herzen spuret
> Was er erschafft mit seiner Hand.

If my readers have carefully followed me thus far in this chapter they will have begun to comprehend that, what is popularly styled disease covers many totally distinct conditions, the treatment and care of which are of necessity, widely different.

Class I included all structural disease, every deterioration and decay, premature or mature, of any bodily organ or organs, whether arising from an original taint or defect in structure, so-called hereditary disease, or from overwork of an originally sound organ, scrofula, gout, rheumatism, congenital syphilis, nervous weakness, consumption (usually a result of scrofula), being familiar examples of this class. The amount of health attainable in each case will vary with the defect and the organ in which it is seated. When once the disease has developed, an ideal state of equilibrium can never again be reached; for in man there is not any power of restoring effaced tissues, such as is seen in certain of the lower animals, lizards, etc. It is true that when an organ is partially or completely destroyed by disease, another organ of similar function will often enlarge and maintain life, and even a fair amount of health, doing for a time double work, but such overwork leads necessarily to its early exhaustion and breakdown. The key to the treatment of Class 1 is *economy.* Minimize the amount of work thrown on the injured structure and, if necessary, endeavour to divert part of it to stronger organs of kindred function. Thus in kidney mischief, let the skin and bowels be maintained in free action; in liver-disease see that the kidneys are active. The symptoms observed in disease of this class are of two distinct kinds—those which result directly from the structural disease, which are few and obscure, and those which are due to the elastic recoil of the tissues in general from substances and under conditions inimical to their equilibrium; these latter are many and important. In gangrene, *i.e.*, mortification of a limb, the discomfort arising from the presence of a useless and decaying mass attached to the body are all that can strictly be regarded as belonging to the former; the red inflamed line of demarcation which separates the healthy from the dead or dying tissue, though ofttimes tender and painful, belongs to the latter group of symptoms, which are always beneficial in their tendencies, and in most cases to be wisely encouraged or imitated by art, whereas the first are *an unmixed evil*, and may be dealt with by remedies having opposite effects.

Class 2 included all the so-called functional derangements. These are not diseases in the sense in which the public use that term. They are *not evils*, but *natural and beneficial processes*, which are taking place in obedience to fixed and known physical laws. This class comprises all those beneficial symptoms to which I have just referred as seen in abundance in structural disease. It includes shortness of breath, vomitings and purgings, dropsies, perspirations, shiverings, signs of inflammation up to an advanced stage, acute gout and rheumatism, boils, carbuncles, skin-eruptions —except of the parasitic kinds—coughs of almost all kinds; in short, nearly all the known *symptoms* of all disease. This class is always to be wisely encouraged—not to be, as is so frequently the case, ardently combated. Expectant, or so-called let-alone treatment, and the application of homœopathic principles, in the sense in which I have already spoken of these latter, here find a truly scientific *raison d'être* and score brilliant successes as compared with antipathic measures. Sometimes, however, a symptom by its very intensity may threaten danger to life or destruction of tissue; in such a case its power and extent must be curtailed by means which produce an opposite effect. Such recourse to antipathic measures is, however, to be regarded as exceptional.

Class 3 includes the cases where equilibrium is lost through want of fuel, *i.e.*, food. This I explained is a small class, and its treatment is obvious.

Class 4 deals with the so-called new growths, cancer, sarcoma, fibrous and fatty tumours, etc., the exact causation of which is still matter of dispute.

CHAPTER V.

THE PRINCIPLES OF DIGESTION.

GENERAL REVIEW OF FOODS AND THEIR DIGESTION.

IN my last chapter I spoke of man as a machine, and I wish for the present to retain this name, so that my reader may clearly understand, a thing that he is apt to forget when the human body is in question, that we have to do with strictly physical processes, exactly analogous to those which we may every day witness in the engine-room of a manufactory or at a railway station. Were I a skilled mechanic, and were my reader an apprentice whom it was my duty to instruct, it is clear, supposing him to have been put in possession of, and to have mastered, a fair general idea of machinery and its uses, that the next three points on which he would require instruction would be:—First, a description of the fuel, with its kinds and its amounts, its relative price and the places whence it is obtained, most suited for this machine. This point we shall consider under the name of *food.* Second, the precise way in which the fuel is consumed and the method whereby it is converted into motive power and fitted for structural repair. This we shall consider under the head of *digestion.* Third, the most frequent causes of derangement in the machine, the external signs by which to judge of these and of their seat, and the best way of rectifying them. This we shall place under the head of *indigestion and its treatment.*

We have then, first of all, to obtain a general idea of the foods which the human body is capable of digesting. It might seem, so great is their variety and source, that it would be impossible to give a very clear and brief classification of these; but the reader will discover, as he proceeds, that the processes of nature are not the tangled mazes which he has pictured them, but rather broad, clear, and simple paths, easy to follow when found, and well worth looking for.

All foods belong to one of the four following divisions, though nearly every known food is a compound consisting of two or more of them in different proportions—

1. The albumens or structure foods;
2. The starches or sugars, } or fuel foods;
3. The fats,
4. The salts.

1. The *albumens*, or structure foods, have one marked characteristic,—they contain the element, nitrogen; hence they are often styled the nitrogenous foods. Now nitrogen is an essential part of all living structures; it is therefore a necessary ingredient in food that is to repair the tissue of the human body. Where then should we seek for it? Wherever protoplasm or living tissue exists—in the flesh of living animals and in the seeds of plants. But neither of those sources contains simply protoplasm; they both possess in themselves stores of fuel food: the seed, to serve it as nourishment in the early days of its life; the animal, to serve as a reserve fund of motive power during temporary privation. In the seed, this fuel food consists of starch and fat; in the animal, of fat only.

THE FUEL FOODS.

2. *Starches* or *sugars*, in chemical language carbo-hydrates or hydrates of carbon, since the hydrogen and oxygen exist in them in the relative proportion of two to one, which is that of the molecule of water. Now this group comprises starch, cane-sugar, grape-sugar, or sugar that is found in ripe fruit, milk-sugar, dextrine and gum; but we can very quickly simplify even this short list. Gum and dextrine are not used as articles of food, or, if they are, they, as well as cane, milk-sugar, and starch, are all first converted into grape-sugar. So that really grape-sugar is the sole member of this group that is capable of being used in the nourishment of the human body. Though this substance is much more digestible

than our familiar cane-sugar, which differs from grape-sugar in being easily crystallisable; yet even grape-sugar, when eaten as such in large quantities, tends to undergo a fermentation in the stomach, and therefore, in place of this sugar, man eats starch, which he possesses the power of slowly converting in his economy into grape-sugar at such a rate as not to permit, in a healthy state of his organs, of an accumulation sufficient to lead to fermentation. Starch, the grains of which under the microscope are seen to consist of many distinct coats, such as we find in the onion, exists in large quantities in the vegetable world, in all seeds and in most roots and stems. Our main supply is, however, derived from seeds. Starch, with one trifling exception, does not exist in the animal world.

3. *Fats* called, in chemical language, hydrocarbons, because they consist of hydrogen, oxygen, and carbon in varying proportions, exist pretty equally in both the animal and vegetable kingdoms; in the latter they are most prominent in what are called the oily seeds, of which the Brazil nut is a good example.

4. The *salts*, those that are required for our daily use, are found in the ordinary articles of food, both vegetable and animal, in the water we drink, and in the table salt which a natural instinct prompts us to take, to supply the place of those salts of which the process of cooking deprives us.

Of course there are many things mixed with our foods, and which we take into our mouths, which do not come under the head of either structure or fuel foods; but these, like the incombustible admixtures with coal, are *not digested*, but are *expelled* from our bodies—they indeed, by the very fact of their being indigestible, stimulate the muscles of the bowel to their own expulsion, thus subserving a useful and beneficial, though not a nourishing, purpose.

Résumé.—For the repair of our structure we consume nitrogenous foods, called albumens, which we obtain from seeds and animal flesh; for the supply of the motive power, necessary for man as a machine, we consume combustible foods, represented by starch and fat. The relative amounts of these different kinds present in our ordinary food will be given later on, as well as a proximate calculation of the amount of each required for daily consumption at different periods of life.

DIGESTION (a Sketch).

Complete digestion consists of three distinct stages.

1*st stage.*—The food is received into the stomach and bowels; here it is acted on by certain ferments, to be presently described, and the digestible parts of it are fitted for absorption into the blood.

2*nd stage.*—The albumens and starches, which have now undergone change, are arrested by the liver, and undergo a second digestion there. The fats do *not go* to the liver, but pass into the general blood-current, without further digestion, by means of special channels called lacteal ducts.

3*rd stage.*—The three kinds of food, the albumens, starches, and the fats, together with the salts, which undergo no digestion whatever, are now finally dealt with by the tissues and the blood.

EXCRETION.

All articles of food that do not belong to one of the four varieties are excreted, or cast out of the body by the bowel. The starches and fats, after entering the blood-current, are either completely burnt up there, or stored in the tissues as fat; but the albumens are disintegrated both by the liver and the cells of the muscles, and the results of this disintegration, in the form of urea, together with the *débris* of tissue-cells in the same form, much of the water derived from the combustion of the fuel foods and from other sources, the salts consumed with food, worn-out and broken-up blood-cells, and certain foreign matters, opium, etc., are excreted from the body by the kidneys, and to some extent by the liver. The skin excretes water and a very small amount of salts. It also, but to a very trifling extent compared with the lungs, takes up oxygen and gives off carbonic acid gas. The oxygen necessary to burn the fuel foods is found in the red cells of the blood, where it is fixed in the act of inspiration. Each act of expiration gets rid of nearly all the carbonic acid and much of the water, which are the chemical products of the combustion of starches and fats.

Such is the simplest description I can give of the processes of fuelling, renewing, and ridding of waste that are found in the human body. I shall now proceed to give an outline of the structure and functions of each organ of digestion.

ORGANS CONCERNED IN PRIMARY DIGESTION AND THEIR FUNCTIONS.

No. 1. The *Mouth* (*its structure*).—The mouth is composed of bones, muscles, and glands, with their accompanying blood vessels and nerves.

The *bones* are the upper and lower jaw, the hard palate and the teeth; but the last mentioned are, strictly speaking, of mixed structure.

The *muscles* include all the soft tissues of the mouth, except the gums and the glands.

The *glands* are of two kinds: (*a*)the mucous, which are thickly studded in the lining membrane of the mouth and throat—the so called mucous membrane; and (*b*) the important *salivary glands* of which there are three sets—one just in front of the ear, the parotid gland, one under the jaw, the submaxillary gland, and one under the tongue, the sub-lingual gland.

Functions of the various structures in the mouth:

Of the bones: to act by means of the muscles attached to them as levers, or as fixed points from which those muscles can act.

Of the teeth: to cut, tear, and grind the food.

Of the muscles: to place the food between the teeth and to roll it constantly in the mouth, so that every part of it may be brought under the action of the saliva; and, when both these processes have been completed, to gradually force the mass back into the gullet—a tube which conveys it to the stomach.

Of the mucous glands: to lubricate the food and the interior of the mouth.

Of the salivary glands: to supply an alkaline fluid in which the ferment it contains, which has the power of changing starch into grape-sugar, can act. The ferment which exists in the saliva and possesses this power is called ptyalin, and is essentially the same in nature and in function with the ferment diastase, found in malted barley.

No. 2. The *Stomach.*—The size of the stomach varies very widely in different individuals and under different circumstances. When moderately distended, in an average man of middle age, its length is about twelve inches, and its measurement from above downwards about four. Its shape under the same conditions is as that in the diagram at the commencement of the book. The stomach wall is composed of four distinct layers or coats. Externally the thin peritoneal layer; next to that the muscular layer; then the submucous layer, which forms a sort of cushion for the innermost layer of all, viz., that which contains the apparatus for preparing gastric juice and for absorbing digested material. The stomach-walls possess also an intricate network of nerves, which are derived from the two great nerve trunks, the sympathetic and the vagus, a large supply of blood-vessels and of lymphatic ducts. Owing to the amount of muscular substance in its walls, the stomach is capable both of great distention, as is seen in some cases where food is habitually taken in excess, or where some impediment to its outlet is present, and, also, of great contraction, by virtue of which it can reduce its natural length and breadth to at least one-half. This latter condition of contraction is, in fact, natural to healthy individuals after the act of digestion in the stomach has been completed.

The functions of the stomach. Of its muscular coat.—To produce, during the act of digestion, a rhythmical contraction and expansion, whereby a species of wave-like movement is given to the whole organ, which serves the double purpose of moving the food gradually onwards and of rolling it over and over, thus subjecting each portion to the action of the digestive fluid. At the inlet and outlet of the stomach this muscular coat becomes thickened, and forms round both orifices a species of ring: that at the inlet is, by a reflex act, opened for the entrance of food and closed automatically afterwards to prevent its return; that at the outlet being worked by a similar mechanism, to allow of the gradual exit of partly digested material. Derangement of the nervous mechanism at the inlet is witnessed in the act of vomiting; that of the outlet, in certain morbid conditions of the body, in which all food that is consumed tends promptly, sometimes in the course of a few minutes, to pass through the body and produce diarrhœa.

Of the peritoneal and submucous coats.—Their main functions are mechanical support.

Of the secreting and absorbing coat.—Its very important function is the preparation of a substance compounded of a ferment called pepsin, and hydrochloric acid, both of which together—since separately they possess no digestive power—I shall in future refer to as pepto-hydrochloric acid or gastric juice.* The sole *use of the gastric juice is the digestion of albumens.* This coat absorbs the digested albumens and the grape-sugar carried from the mouth, that is, it conveys these into the blood-stream.

No. 3. *The Liver.*—The position of the liver is to the right side of the body, and extends in health from just below the right nipple downwards in a straight line to just below the edge of the ribs. Transversely it extends from the extreme right side of the centre of the body to a trifle beyond the middle line. As it is an organ of very important functions, and as those functions are nearly all concerned in the process of secondary digestion, I shall not here endeavour to give any detailed description. The part played by the liver in *primary* digestion is the *secretion and outpouring of bile.* The functions of bile are as follows :—

(*a*) To break up the globules of the fats that occur in our foods, reducing these to smaller particles so as to render them capable of entering the mouths of the minute lacteal glands in the intestine. This action is said to cause an *emulsion* of fat.

(*b*) To moisten the walls of the intestine, and thus aid the absorption of fat. This has been proved experimentally to be a fact, though the exact method by which it is effected still remains a mystery.

(*c*) By means of a ferment called diastase, to convert starch that may have escaped the digestive action of the ferment, ptyalin, in the mouth, into grape-sugar, so as to render it capable of being absorbed. The amount of diastase in bile is, however, small; and this function of bile quite a secondary one.

(*d*) To excite contraction of the muscular wall of the bowel, aiding thus both digestion and the rapid outward progress of waste and indigestible material, acting thus as a natural laxative.

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* I must again remind the reader, especially if he be a medical man, that in a work of this kind, intended for lay readers, it is not the place to enter on the question of minutiæ, as to whether the pyloric glands secrete pepsin only, and no acid, and so on.

(*e*) To prevent decomposition by acting as a disinfectant and as a destroyer of many of the kinds of bacteria.

No. 4. *The Pancreas*, or sweetbread, is an organ whose share in the digestive process is a very comprehensive one. Its position, as shown in the diagram, is just below the stomach. Its shape has been aptly likened to that of a dog's tongue. Like the salivary glands in the mouth, it is made up of numerous so-called lobules which have the appearance of minute bunches of grapes. Its function is to pour into the bowel, by a channel which usually joins the bile-duct, a fluid of powerful and varied digestive properties.

The Pancreatic Fluid.—The very existence of this fluid, which is capable by itself o fperforming the digestive functions of all the other organs concerned in primary digestion, is unknown to many a dyspeptic who considers himself well versed in the processes of digestion. The chemical reaction of pancreatic juice is alkaline.

It contains the following principles :—

(*a*) *A ferment, called diastase, or amylopsin,* which converts starch that has escaped the action of the ptyalin in the saliva into grape-sugar.*

(*b*) *A ferment, called trypsin,* which has, like the pepsin in gastric juice, the power of rendering albumens soluble, *i.e.*, capable of passing into the blood.

(*d*) *A ferment, called steapsin,* which splits fats up into glycerine and fatty acids. The alkalies in the pancreatic juice join with a part of the fatty acids and make *soaps* ; the remainder of the fatty acids are converted into an emulsion. The emulsion, the soaps, and the glycerine are all absorbed by the intestine.

(*e*) *An emulsifying principle* (called emulsin), by virtue of which, like the bile, it can emulsify some of the fat and also the fatty acids.†

No. 5. The *intestine* is the last organ concerned in primary digestion. It is divided into two parts :

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* This diastase has a powerful effect even on *raw* starch, whereas ptyalin has but a very small effect upon any but *boiled*, starch.

† Both the stomach and the pancreas are, in addition to the functions I have described, credited with a small amount of a special milk-curdling ferment.

The *small bowel*, which commences at the outlet of the stomach, the first few inches being called the duodenum, extends to what is called the ileo-cœcal valve, situated in the region of the right groin. The small bowel is about twenty feet in length.

The *large bowel*, the continuation of the small, commences at the ileo-cœcal valve and extends to the outlet. Its length is from four to six feet.

The structure of the whole bowel consists, like that of the stomach, of four layers or coats—a peritoneal, a muscular, a submucous, and a secreting and absorbing one. The functions of these various coats is,—of the muscular, to force, by gradual contractions, useless material to the outlet, and to expose all other substances equally to the action of the digestive fluids; of the peritoneal and submucous, to act as supports; of the secreting and absorbing one, to pour out a digestive fluid, bearing probably a general resemblance to pancreatic juice, but whose exact nature is unknown, and whose power is probably feeble, and to absorb or take into the blood-current all grape-sugar and digested albumens, and into the lacteal system of ducts all emulsified fats, fatty acids, and soaps.

Finally, all articles taken as food, that are insusceptible of digestion, and all food taken in excess of the digestive powers are finally expelled from the body, the irritation which they produce aiding, by reflex action, their expulsion. For this reason doctors often advise people to eat food, such as coarse brown bread, figs, fruit, &c., which contain, in the husks of the grain and in the pips of the fruit, indigestible material which has mechanically a laxative effect.

I should mention, before I leave primary digestion, that the whole digestive tract, mouth, stomach and bowels, is lined by a fine membrane called a mucous membrane, studded with mucous glands.

THE ORGANS CONCERNED IN SECONDARY DIGESTION AND THEIR FUNCTIONS.

Before we can understand the processes of secondary digestion, we must first take a glance at the changes which our foods have undergone in the primary process, because it is with these altered foods that we have now to deal.

Starch has undergone conversion, by means of the ptyalin in the saliva, into grape-sugar, and has been absorbed by the blood which leads to the portal vein.

Albumens have been changed, by the pepto-hydrochloric acid of the stomach and the trypsin of the pancreas, into what are called peptones, which have also been absorbed by the blood going to the portal vein.

Fats have been split up and emulsified by the bile and pancreatic secretions and have passed into the lacteal ducts, which will conduct them by certain channels, direct into the *main* blood-channels. Therefore *fats undergo no secondary digestive process.*

In short, in secondary digestion we have to consider only the further processes which grape-sugar and peptones undergo in the blood of the portal vein, and in the liver.

There are thus two organs concerned in secondary digestion—the portal vein and the liver.

The Portal Vein.—This blood-channel collects from the stomach and bowel, by means of its tributaries which are distributed over their walls, all the grape-sugar and peptones, as well as everything else, except fat, that is absorbable, and carries them to the liver.

Its functions.—As far as the grape-sugar is concerned, it merely acts as a channel for its conveyance ; but *on peptones* its blood seems to possess a decided action by transforming a large part of them* into serum-albumen, in other words, into albumen of the blood, or circulating albumen. The remainder of the peptones pass on to the liver.

But this digestive process in the portal vein is comparatively a trivial matter, and the great organ concerned in the secondary processes of digestion is the liver.

The Liver, the largest gland in the human body, is a solid organ, extending, as I have said, in health, from an inch or so below the right nipple, in a perpendicular line, to just below the border of the ribs, and transversely from the extreme right of the body to a short distance past the middle line. Its exact position varies, however, somewhat with that of the individual, whether he be standing or lying down, inhaling or exhaling deeply at the time. In infancy, it should be remembered that the size of the liver is relatively much greater than in more advanced life—a fact often brought home to nurses by observing how prone a child is to be sick, from the mere weight of the liver resting on the stomach, when the child, just after a full meal, is laid on its left side. The liver is surrounded by a covering or capsule of fibrous material which sends processes into the substance of the liver to separate the lobules from each other. It consists of a collection of exactly similar minute lobules, from 1-24th to 1-12th of an inch in diameter. If I therefore undertake the description of *one* lobule, I shall practically be giving a description of the whole organ.

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* It is probable that in a state of health *all the peptones* are thus dealt with ; but this point is not yet cleared up, and in considering the disorders of secondary digestion, I shall therefore omit any reference to it.

As we have seen, the portal vein runs directly into the liver; when there, it subdivides into smaller and smaller branches; the smallest of all (which consist of such extremely thin walls that their contents pass freely out of them) are in close contact with the liver-cells, which cells possess certain powers, that, a little further on, it will become my duty to describe. After pursuing their course amongst the network of cells, these minute blood-vessels unite together in the centre of the lobule, to form what is called a *hepatic vein*; this vein, as it emerges from the lobule, joins other similar veins, which, united, leave the liver as the *great hepatic vein*, which goes direct to the heart, and there pours its blood into the general circulation. The blood of the portal vein contains grape-sugar, serum-albumen, and some peptones, the former resulting from the starchy, the latter two from the albuminous articles of food. I have already said that this blood comes in close contact with the liver-cells; in fact, some of its constituents actually flow out of the channels, and are taken up by the cells, and amongst those substances are sugar and red blood cells, peptones, and serum-albumen.

What does the liver, as represented by cells, do with the grape-sugar and albumens? The grape-sugar it converts to, and stores up as, glycogen or animal starch, and this again it reconverts *regu-*

larly and slowly into grape-sugar, and allows to pass into the great hepatic vein in such quantities as can be consumed by the oxygen of the blood. This is one of the most extraordinary functions of the liver: but for this beneficent provision, we should, directly after each meal in which we consumed starch or sugar, find a large amount of grape-sugar suddenly thrown on the circulation, and the result would be, that the surplus, over and above that which the oxygen present in the blood could consume, would pass out by the kidneys, setting up many symptoms of mischief in them and in other tissues of the body. Other disasters would follow; for unless we continued constantly to eat, made life, in fact, one long meal, the oxygen in the blood would begin, directly the stock of fuel supplied by a meal was exhausted, to burn up first the reserve fat and then the tissues themselves. This is exactly what occurs in diabetes, a disease in which this power of storing up grape-sugar is lost.

Let us now consider what the cells do with the *albumen* which they also withdraw from the blood of the portal vein. A part, probably an amount graduated, like the sugar, with some nicety to the needs of the body, they, after altering slightly, allow to pass on into the hepatic vein, whence it goes to repair waste of tissue. Another part is, together with some red-blood cells, which the liver breaks up, formed into bile, and poured into the duct which carries that fluid to the bowel. But these are not the only constituents of bile. The salts taken with our food are also largely used in its manufacture. Foreign bodies, poisons of various kinds, are also passed on into it, as also doubtless are, very frequently, the living germs called bacteria. In its action on the albumens, a waste product, called *urea*, is produced also by the liver-cells. This is passed on into the blood-current and excreted by the kidneys. We have seen that the power which the liver possesses of arresting and storing the grape-sugar is sometimes lost. Its power of efficiently acting on albumens is also frequently defective, and sometimes becomes permanently disabled. In such cases what do we find? That *uric acid*, a less oxidized substance than urea, is produced in place of part of the urea, and thrown, with the latter substance, into the blood-current. Probably, in a state of health the liver always produces some uric acid, for from seven to ten grains on a mixed diet, and from twenty to thirty-five grains on an excessively nitrogenous diet, are daily excreted by the kidneys, and though much of this comes from the tissues, as I shall show in speaking of tertiary dyspepsia, and perhaps a certain amount is produced by the action of the kidneys themselves, yet when the liver becomes deranged, or when its functions are persistently overworked and a break-down of them occurs, uric acid is formed in the liver itself *largely* in excess of its normal amount, and, being very insoluble, forms crystals which deposit themselves in the smaller joints of the body, producing the disease known as gout. These crystals are composed of a compound of uric acid and the soda salts with which it unites in the blood.

Let us make a short *résumé* of this somewhat complicated process of secondary digestion.

In the portal vein, grape-sugar travels along unchanged, but some of the peptones absorbed from the stomach and bowel are converted to circulating albumen. *In the liver* the cells take up sugar and store it as animal starch, *i.e.*, glycogen, serving it out to the body as required. The cells further act on the peptones changing them to circulating albumen. The rest of the peptones, probably that amount over and above the immediate body-needs, go to form the bile-acids. These acids unite with the soda and potash salts brought also by the portal vein, and, together with the colouring matter from some red-blood corpuscles, which the liver-cells destroy, and some mucus, go to form bile. A bye-product, in the action of the liver-cells on the albumens, is called urea; and this substance, with possibly a small amount of uric acid, is passed on into the hepatic vein, thence to the general blood streams, and finally to the kidneys which excrete it; * a small amount, however, returns to the liver by the hepatic artery.

THE ORGANS OF TERTIARY DIGESTION AND THEIR FUNCTIONS.

In tertiary digestion, I include all those changes which occur in the substances derived from our food, after these have entered the general blood-stream. Let us enumerate them :—emulsified fat, grape-sugar, circulating or serum-albumen, and salts.

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* A little glycogen, or animal starch, is formed by the liver even out of the albumens; but the amount is very small.

All these are present in the great blood-stream, the great hepatic vein, and are poured into the right side of the heart, pumped thence with all other venous blood through the lungs, to return as bright-red arterial blood, for distribution to the body, for the repair and building up of tissue and the production of heat or motive power,

It may be said that I cannot class the final changes which foods undergo as *digestion* at all, in the proper sense of the word, and that the term, assimilation, is the only word that correctly describes the process. *Stoffwechsel*, or tissue-interchange, is the favourite word for the process in Germany ; metabolism, which practically means the same thing, is the scientific word most in vogue in England. But in reality there is no essential difference in the *manner* in which the food is dealt with in this stage, from that which it undergoes in the first two, which are admitted as digestive. In these we found chemical changes going on, whereby heat and energy, though probably but to a small extent, were evolved, the food each time going through a kind of metamorphosis. In this, our third and last change, we shall see precisely the same actions in progress. True, we have here an interchange of tissue; some of the circulating albumen going to repair the breaches, if I may so express it, made by wear and tear, in the cell-structures; but this interchange is exceedingly small, and represents a mere fraction of the food supply of the body, and in no way justifies us in adopting a special name, such as assimilation, for the process. With this explanation I proceed.

The *emulsified fat* is partly used as fuel, and in part stored up in the body as fat, though some of it is apparently actually consumed by the white-blood cells, which are free moving bodies endowed with a large amount of independent motion, by virtue of which they can leave the blood-channels, by penetrating the walls, and mingle with the cells of the body. They are each a typical living animal of the amœba species, and to be kept distinct in the mind from the red-blood cells, which, though infinitely more numerous, are not endowed with such powers, but may be regarded as mechanical bearers of oxygen to, and of carbonic acid from, the tissues.

The grape-sugar is also used as fuel, burnt up by means of the oxygen which is taken up by the red-blood corpuscles in their passage through the lung; these corpuscles possessing a special chemical compound, found only in the animal world, and called hæmoglobin, which has the power of fixing for a time in the blood-cells the oxygen of the air drawn in by the act of inspiration.

With the circulating albumen the course is altogether different, and the exact processes much more obscure. In the consideration of man as an individual, in the earlier part of this book, I have explained that the arteries divide and subdivide till at last the channels become so minute that their walls consist of but a single layer of cells, and the nutrient fluids which they contain can and do ooze out, and supply each cell with food and working material. This food and working material are the circulating albumen of which we are now speaking. This albumen is then the repair-material of which the cells avail themselves; it is also that from which they prepare all the secretions of the body. The unneeded surplus, together with cell-débris and other nitrogenous compounds, such as urea, pass from among the cells into small lymph-spaces, whence, by way of lymph-channels and capillaries, they are conducted back into the blood-currents to be excreted as useless by the kidneys.

Such is the final use and course of the albumens which we consume with our food.

The Salts.—The balance not used by the liver in the formation of bile, passes on, partly to supply the blood with any deficiency, and largely to travel with the circulating albumen, and assist its final changes.

Finally, the kidneys discharge—

The Urea, }
The Uric acid, } from the liver and tissues.

Water, produced by the combustion of sugar and fats, as well as that consumed with food.

Colouring matter derived from the blood,	small amounts only
Kreatinin, *&c.*, representing, in part, the waste from cells	
Inorganic Salts of various kinds	

This completes my sketch of the three processes through which all food passes. My readers will, I fear, be a little daunted when they peruse the account of the various stages, and the complexity of the changes undergone. The fact is the public have practically no real idea of the digestive process, and, I may even add, that it is but yesterday, so to speak, that the profession itself awoke to a realization of what it comprises. I have now lying before me treatises, not half-a-dozen years old, written by eminent scientific men, and professing to deal with the subject of dyspepsia, but not one word do they contain about any other of the failures of the process except those which occur in the stomach ! Even our old friend, the liver, which, by the way, in the light of modern science has vindicated the important place it held in the estimation of the ancient physicians, has been passed by. No doubt, gastric digestion is a very important process ; but were that *alone* of all digestions to go on, not one of us would be alive in a fortnight's time, however perfect might be the process. Perhaps I should be more correct in saying that not one would live forty-eight hours, for the products of digestion by the stomach, peptones, have been pretty conclusively shown by the researches of Dr. Lauder Brunton to be *in themselves* potent poisons !—poisons which are converted by the digestive functions of the liver to beneficent, life-supporting foods.

What wonder that dyspepsia was the opprobrium of medicine ; that physicians almost shuddered when the word left the patient's mouth ; that men of the highest intelligence, such as Carlyle, suffered a life-long martyrdom,[1] and lost all faith and hope in science. What could science, with its limited knowledge, do for such as him ?—nothing but mischief. Signs of great improvement, however, have appeared. Scores of eminent observers, in England and on the Continent, are engaged in sifting the whole matter, and scarcely a week or month passes without some solid advance in this direction. For myself, my object is to write for the intelligent public ; and I should be paying them an indifferent compliment, and stultifying myself in the minds of all right-thinking persons, if, for the sake of an apparent clearness and simplicity, I were to omit any essential part of the subject.

But, since the digestive process in all its perfection has been exposed to the contemplation of the medical world, great and unexpected light has been thrown on the causations of many diseases, which before were most obscure. Gout, rheumatism, Bright's disease, diabetes, are, amongst well-known and terrible diseases, all but forms of dyspepsia; whilst consumption, rickets, scrofula, melancholia, and even many of the specific fevers, are shown to be allied to the same complaint. There exists a certain medical school which would ascribe every complaint to the agency of the nervous system, and such a form of belief contains a certain specious truth. It is as if we should ascribe the fall of a house, that was notoriously shaky, to the act of God. Everything, of course, is admitted to be the act of God; and in the human body every function depends on the nervous system, which directly rules and regulates each cell of which the body is composed. But such a reflection should not lead us to a cynical pessimism—a position apt to be assumed by the school to which I refer. It is true that diseases of the nervous system are exceedingly difficult to treat when they are regarded as *nervous diseases*; but when they are treated as an evidence of *general bodily derangement*—for the nervous system is not an independent entity, but as dependent on the general equilibrium as any other system or organ in our body—on broad hygienic principles, they often right themselves.

I ask my readers, then, for their own sakes, to try and master the essentials of the digestive functions; and, to make matters clearer, I will once more review the digestive ferments, and show the simple and uniform manner in which they all effect their purpose.

TABLE OF FERMENTS WHICH PRODUCE THE DIGESTION OF FOODS.

General characters of all.—All products of certain cells, most active in a temperature of 30° to 35° C. When in a *dry* state they can be subjected, uninjured, to the boiling temperature, but are destroyed at that heat if moisture be present. They act only on certain compounds that contain carbon. They are not endowed with life, and are therefore called *unorganized* ferments, to distinguish them from living ferments, such as yeast. They all contain nitrogen.

CLASS I.—These act by causing each molecule of food to take up one molecule of water. This change confers on the food the power of passing through animal substances, such as the walls of the stomach and bowel.

Where they occur	Name.		Action.
In saliva of mouth,	ptyalin	converts	starch into grape-sugar.
In stomach,	pepsin	,,	albumens into peptones
In pancreas,	diastase	,,	starch into grape-sugar.
,,	trypsin	,,	albumens into peptones.
,,	steapsin	,,	fat into fatty acid and glycerine.

As a result of the above processes, and of its emulsification by the bile, fat passes through the abdominal wall to the lacteals. and the albumen and grape-sugar pass through the walls of the stomach and bowel to the portal vein. They are there deprived of the extra molecule of water, and, losing with it their power of passing through animal membranes, are arrested in the liver.

CLASS 2.—

Where they occur	Name.	Action.
In blood distributed to the liver,	diastase.	The grape-sugar arrested by the liver, and stored as animal starch or glycogen, is slowly converted by this diastase again to grape-sugar.

Various minor ferments—the milk curdling, the inverting, whereby cane sugar is turned to grape-sugar, the fibrin forming, and that which turns milk-sugar to lactic acid—have been omitted, as their action is *slight*, though entirely *similar* in kind to the great ferments above.

To sum up.—Digestion consists, essentially, of the addition of one molecule of water to each molecule of food.

CHAPTER VI.

PRIMARY INDIGESTION—THE MOUTH.

INASMUCH as we have seen that the process of digestion itself, when rightly viewed, consists of three distinct stages, it follows that when we come to the consideration of the commoner faults and failures in digestion, and the measures to be adopted for their relief, we shall have to regard the subject from a threefold standpoint, namely, failures of primary digestion, or primary indigestion, failures of secondary digestion, or secondary indigestion, and failures of tertiary digestion, or tertiary indigestion.

We first of all take up *primary indigestion*, which includes a discussion of the causes which lead to, and the symptoms which attend on, derangements of the mouth, stomach, pancreas, and intestine—for the action of the liver is concerned so largely in secondary digestion, that we shall relegate the disorders of that organ to the second part of our subject—and a philosophical consideration of the best and most common-sense methods of combating such derangements by general hygiene and the applications of medical science, strictly so called.

The Mouth.—For the due performance of its duties, *i.e.*, the crushing and grinding of food and the transformation of starch into grape-sugar, the mouth requires suitable powers in the muscles which act on the lower jaw, a sufficient supply of teeth, and a plentiful secretion of saliva, rich in the ferment, *ptyalin.*

(1.) *Imperfect muscular power.* This is present in some forms of paralysis and in states of great general debility, and is a natural consequence of advanced life.

Treatment. Hygienic principles.—Whatever the cause, it is best, as a general rule, to rely for nourishment on liquids or semisolids. In cases where there is good reason to believe that the digestion of albumens is fairly well performed, and the imperfect muscular power is of a temporary nature, well-made meat broths, thickened with plain biscuit or some form of cooked flour, steamed or boiled fish, oysters, raw or simply warmed, but never cooked, may be allowed, together with a reasonable supply of some of the following, which should form the *inclusive* nourishment of those who suffer from chronic gout, from an advanced stage of natural decay, from recent and severe paralysis, from some advanced forms of mental weakness, and from a state of feverishness; gruels, hominy, milk puddings, fruit and cream; milk, preferably that which has been boiled; koumiss, malted foods, succulent vegetables, and meat jellies.

Scientific principles.—Electricity forms, in cases where there is a good reserve of vital force, and the patient is recovering slowly, and, in some cases of loss of power due to hysteria, a useful means of cure. The patient should, for the purpose, sit on a chair, the feet of which rest on strong glass salt-cellars, his naked feet being placed on a sheet of copper to which one pole of the battery should be attached; the other pole, slightly moistened with salt and water, to be grasped by the operator, who should, with his empty hand, stroke the cheeks in a direction from just below the eyes to the inferior edge of the lower jaw. The process may be repeated two or three times a day, according to the severity of the case. A very mild current is all that is required. Where loss of power is due to old age or organic disease of nervous tissue, electricity is of course useless.

For these last cases 5 to 10 drops of tincture of nux vomica in a wine-glass of water, two or three times a day, as a general muscular stimulant, and the placing of the patient under as perfect hygienic conditions as his age, the length of his purse, and other considerations will allow, are the limits of active treatment.

(2.) *Teeth, deficient in number and in health*, are not unfrequently a potent factor in producing indigestion. There is a vast amount of ignorance in connection with the question of a good dental supply, to an attempt at the correction of which I must devote a few lines. Children are born without teeth simply because they do not require, and could not, owing to want of development in the muscles of the jaws, efficiently make use of them. The first tooth should appear at about the age of six months. If teething commence before that period, the guardians of the child should not be congratulated on the fact, for such precocity is more often a sign of that general precocity which we see in delicate children affected with that form of scrofula called tuberculosis, than an evidence of robustness, and teeth thus early formed are exceedingly prone, as are the individuals who possess them, to undergo premature decay. Backwardness in dentition is a still more marked sign of weakness, and in cases—and such are not unfrequent in towns—where the first year of life is completed without the appearance of a tooth, rickets, or that other form of scrofula, the coarser type, which is marked more by general backwardness and bluntness of perception than by the *precocity* of the tubercular kind, may be suspected. Sometimes, however, errors in feeding are alone responsible for the delay.

Directly the child has the first four incisor teeth, let it begin to use them, and all subsequent teeth as they appear; and there is nothing, that I know of, better fitted for the purpose than a piece of the crust of a well-baked loaf, which nurses, often in spite of discouragement from the family doctor, have, from time immemorial, delighted to place in an infant's hands. To the teeth and jaws applies the universal rule which underlies the success of all athletes, namely, that, up to the time when the vital energy begins to fail, the more any part of the body is regularly exercised, the greater will be its blood supply, and, in most instances, the better its development.

In youth and middle-life the teeth should be healthy and sound. That they often are not so is due to several causes, the principal of which are the inherited weakness of the individual, a want of general health due to his manner of living, more or less chronic derangement of the stomach, which reacts on the nature of the saliva secreted, and is probably the cause of the decay of the teeth so frequently witnessed in pregnancy, and finally, the nature and amount of the food consumed. The want of tooth-powder and the infrequent use of the tooth-brush, though both have become necessaries of modern life, have nothing to do directly with decay, and I have met scores of persons, who had never known the use of either, whose teeth were yet strong, white, and firm, and whose breath had not the least unpleasant odour, but these were invariably persons whose lives were passed under the best conditions, and whose food was simple and largely of a vegetarian nature.

In old age the teeth fall out. This is nature's provision; and one of the greatest absurdities that can be witnessed in modern life is to see an old man trying to keep pace with individuals whose years are but a fourth of his own in the consumption of meat and fish, poultry and pastry, his mouth splendidly fitted with a perfect armature of thirty-two teeth of the whitest porcelain, he all the while being perfectly contented and happy in the idea that the food he is consuming is building a bulwark between himself and death. In nineteen cases out of twenty such gastronomic feats bring pain as well as hasten death. The hardened gums of the aged, when they have not been scarified by the friction of artificial teeth, are most useful, first to enable them to eat, and, secondly, to warn them that, in their foods, if they wish for a prolonged life, they must ever be mindful of the fact that their reconstructing requirements are low, and that the diet should be duly proportioned to them. If they forget this, the overworked kidneys will soon begin to fail, and death will not then tarry for long.

Still, the modern dentist is a boon, and I strongly recommend everyone over fifteen years of age, and many under that age, to pay a periodical visit to him, say, once or twice a year, so as to secure the benefit of his advice, even if his assistance be not required. Artificial teeth are, again, most useful to the middle-aged, who have prematurely lost many of their teeth; and in old age they are perfectly admissible as adornments, and even in some few cases as assistants in the mastication of food. I shall not delay longer over this subject, but with one or two general hints, and a short list of good tooth-powders, I shall pass on to other subjects.

The teeth should be brushed twice a day at least, a camel's-hair or badger-hair brush being used. Particles of food impacted between the teeth, especially particles of meat, should be removed with a quill or wooden toothpick.

Hot, rich, stimulating foods, and a too highly nitrogenous dietary, *i.e.*, containing an excess of meat, fish, peas, &c., should be avoided as far as possible. Every adverse condition that affects the general health tells on the teeth.

The following may be commended as excellent tooth-powders :—

1. Powdered Castile soap, oil of blue gum, 1 drachm of each, precipitated chalk 2 oz. Mix well. If the oil of eucalyptus be objected to on account of its taste, an equal amount of oil of Scotch pine may be substituted.

2. Dr. Bowditch's saponaceous tooth-powder.

3. Castile soap in powder, precipitated chalk, of each ½oz. ; borax, powdered orris-root, of each ¼oz. ; oil of lavender, 20 drops. Mix.

4. Powdered cuttle-fish bone, 1oz. ; bicarbonate of soda, 1 drachm ; powdered areca-nut, ½oz. ; oil of orange, 20 drops. Mix.

5. The following is the special formula of a fashionable West-end dentist :—Quinine, 1 drachm ; powdered Peruvian bark, ½oz. ; powdered myrrh, ½oz. ; powdered orris-root, 1 drachm ; precipitated chalk, 3oz. ; essential oil of almonds, 5 drops. To be kept in a bottle well corked, or in a close-fitting tin box, as *all* tooth-powders should be.

6. In cases where the gums show signs of receding from the teeth, and are red and irritable, or what is called *spongy*, and bleed on slight pressure, one of the following will be found useful :—Powdered orris root, 2 drs, ; powdered chalk, 2 drs. ; bicarbonate of soda, 3 drs. ; tannin, 1 dr. ; oil of lavender, 15 drops. Or,

7. Tannin, ½ dr. ; tinct. of rhatany, 5 drs. ; tinct. of tolu, 1 dr. ; tinct. of orange peel, 2 oz. Make a lotion, for application on lint or chamois leather, or by means of a soft tooth-brush, two or three times daily.

A useful mouth-wash may be made of 20 or 30 drops of Sanitas fluid or of half a teaspoonful of sal volatile, in a wineglassful of warm water. Once a month it is often advisable to clean the teeth with a little plain powdered pumice-stone, which will remove incrustations that have resisted the effects of the milder tooth-powders. Charcoal is not a good ingredient in a tooth-powder : its antiseptic powers are feeble, and its gritty particles scratch the teeth.

(3) *An altered state of the saliva.*—This is the commonest, and the most important cause of indigestion occurring in the mouth. There are, as I have already said, three sets of glands concerned in the preparation of saliva—the parotid, near the angle of the jaw: the submaxillary, under the jaw; and the sublingual, under the tongue. In the adult they *all* possess, by virtue of a ferment called ptyalin, the power of converting *cooked* starch into grape-sugar, which, on being swallowed, is, without undergoing further change, absorbed by the blood vessels in the wall of the stomach, passing thence to be stored up in the liver. The *amount* of saliva thus used per diem varies from one half up to three pints. In infancy, from the time of birth up to the first appearance of teeth, *only the parotid glands* prepare saliva containing ptyalin, and that but to a small extent. There is no real foundation for the statement that newly born children cannot digest boiled starch at all. The power to do so exists, but is very limited. The reason for exercising great caution in employing starch foods in infancy lies in the fact that food taken at that period if in excess of the digestive powers undergoes acid fermentation in the stomach very quickly, and this condition reacts on the mouth, producing there an *acid* secretion of saliva, or checking the secretion altogether, and thus *all* digestion by the mouth is brought to a standstill, for the digestive power of the saliva is in abeyance if the saliva become acid.

There are, however, certain preparations of starch which a young infant, even before the teeth have appeared, can, in some exceptional instances, be allowed to take in fair quantities, such as baked flour and artificially digested, *i.e.*, malted foods. In the act of baking, if properly carried out, starch is converted into grape-sugar, and therefore baked flour has always formed, and still forms, the basis of many excellent baby-foods. The reader will perhaps remember what I said in my first chapter about seeds—that they possess a store of starch, and a ferment, which, under certain conditions of heat and moisture, slowly converts the starch into grape-sugar for the nourishment of the plant. Barley possesses this ferment in a marked degree, and in the artificial germination carried out in the malt-house it is well developed. In the making of beer the malt is mashed with hot water, which assists further the development of the grape-sugar. This admixture is technically known as *wort*, and the evaporation of it results in what is known as a "malt extract." Such a malt extract is highly nourishing, and, as most of my readers are doubtless aware, finds a somewhat prominent place in modern therapeutics, in the treatment of wasting complaints. But this malt extract possesses little power over the digestion of starch foods, as its diastatic or fermenting and digestive properties are nearly exhausted in its preparation. Within late years it has, therefore, commended itself to those who interest themselves in dietetics to try the effect of the germinating barley grains, before the hot water has been added to them. These have, therefore, been ground, and a *malt flour* has been thereby produced. This substance is rich in diastase, and, when added to warm starchy foods, it exerts a considerable digestive power over them, and forms a useful ingredient, as I have already remarked, in many foods. One important point must, however, always be kept in mind, namely, that *boiling completely destroys* the digestive power of malt. The activity of malt is at its greatest at about blood heat, 98° to 99° Fahrenheit, though it will stand, without complete loss of its activity, a much higher temperature.

If, therefore, it be considered in any given case desirable to make use of malt, two courses can be pursued. Either a food already malted may be bought, but this should have been so prepared as not to require boiling; or malt flour may be procured, and this—one teaspoonful to eight or ten tablespoonfuls of food—may be added *after* the food has undergone necessary boiling, and when it is just cold enough to sip. The admixture should be thorough, and the food allowed to stand in a warm place for ten to fifteen minutes, to allow the malt to exercise its full power.

Similar methods may be recommended for preparing foods, nourishing and easy of digestion, for adult invalids and persons whom it is desired to fatten. But it should be remembered that the conversion of the starch of the food into grape-sugar renders any considerable addition of cane-sugar, for adult palates at any rate, unnecessary; but this natural sweetness need not render such digestive food unsuited for the bilious, for grape-sugar is much less prone than cane-sugar to cause acidity.

Many infants' foods consist of baked flour and malt flour—an excellent combination, which ensures for infancy a very useful food. It must, however, always be remembered that, up to the period of the appearance of the teeth, *milk, and milk only*, is the best of all nourishment, and that starch foods, even when prepared by the most approved methods, should only be given with great discretion, by a doctor's sanction and under his direction.

In adults, several conditions have a powerful influence on the secretion of saliva.

1st. *The food taken.*—M. Preterre, an eminent French scientist, has, as a result of long experiments, come to the following conclusions. That persons living in towns, and eating largely of meat, have an abundant supply of saliva, which, however, is poor in digestive virtue, and tends to deposit carbonate of lime, which substance mixed with the *débris* of food forms what it known as tartar, on those portions of the teeth which are least exposed to friction. He adds that country people, who live largely on vegetables and who eat much fruit, suffer but little from this unsightly and noxious deposit. A greenish deposit occasionally seen on the upper incisor teeth of children, and partly hidden by the lip, has a specially injurious effect on their teeth. Like tartar, it is a deposit from unhealthy saliva, and the treatment consists in its speedy removal. To prevent its recurrence, the child's diet must be regulated and everything rich and stimulating be eliminated.

2nd. *The fluid taken.*—Very acid drinks taken with starchy foods tend to check the digestive power of saliva, for the ferment, ptyalin, can only act in an alkaline medium. The organic acids, *i.e.*, those present in fruit, have not, however, nearly such a deleterious effect in this respect as the inorganic acids (sulphuric acid, nitric acid, &c.) But this point is not one of very great importance, as people do not as a rule elect to consume acid drinks with a meal that consists largely of starchy foods. The effect of one acid —namely, tannic acid—on the digestion that occurs in the mouth has, however, of late become a matter for thought and investigation, since this acid occurs somewhat largely in tea, a beverage which is consumed with bread and butter, milk pudding, and starchy foods generally. Some investigations by Sir William

Roberts, reprinted from a course of lectures delivered by him, tended to prove that tannic acid, even in very minute quantities, had a powerfully inhibitory effect on the digestion of starchy foods; but the conditions under which the experiments were of necessity conducted, namely, in glass tubes, are so utterly different from those actually present in the human mouth as to nullify the conclusions. My readers need not therefore have a constant dread of tannic acid, when they consume their morning and evening beverages, for even if the tannic acid be deleterious, it may, as Sir William Roberts points out, be neutralised by adding a little bicarbonate of soda to the teapot, a very small quantity, about as much as will lie on a threepenny-piece being ample when tea is made for three persons.

Hot fluids of any kind, except when taken under medical advice and with a well-defined object, are, equally with hot foods, deleterious in the long run to salivary digestion. They over-stimulate the secretion of the saliva, and thereby, if persisted in, lead in the long run to a failure of this part of the digestive process.

3rd. *The state of the stomach.*—That the state of the stomach is often mirrored on the tongue has long been known, but until within late years it was thought that a depraved, coated condition of the tongue was the result of direct extension from the stomach. This has, however, been shown to be a mistake, the derangements of the tongue, and even of the teeth and saliva, which are observed in stomach-disorders, being the outcome of reflex-nerve irritation.

If simple food, at regular intervals and in the quantities required for the nutrition of the body, be the régime of the individual, and if an abundance of fresh air and exercise* keep the blood supplied with a due amount of oxygen to burn up the combustible foods, and if the vital energy of the individual be not approaching exhaustion, the nerve impulses, telegraphed (through the reflex centre) from the stomach to the salivary and mucous glands in the

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* The effect of exercise on the amount of air drawn into the lungs is not generally known.

Walking at the rate of	1 mile	an hour	it equals	912	cubic inches per minute.
,,	2 miles	,,	,,	1320	
,,	4 miles	,,	,,	2400	
,,	6 miles	,,	,,	3260	

mouth, will be equal to the production of an efficient supply of saliva and mucus, containing exactly those ingredients which are necessary for healthy digestion. If, on the other hand, the surface of the stomach be perpetually teased by a surplus of food which it has not the power of digesting, and which consequently undergoes an acid fermentation, or by food which, though not excessive in quantity, consists of combinations difficult to deal with, or by the presence of alcohol or other powerful stimulant, the salivary and mucous secretion of the mouth will be at first excessive in quantity, but necessarily diminished in quality, and later on will become diminished in both respects. This reflex effect of the stomach on the salivary glands is very marked in some stomach-derangements. In that which results from a too exclusive diet of oatmeal, it is often evidenced by water-brash, *i.e.*, by an enormous flow of saliva from the mouth. In cancer of the stomach the same symptom is also very prominent.

Now healthy human saliva is not only a powerful digestive agent, but it also possesses some slight antiseptic power which tends to prevent putrefaction; therefore, if it be present in due amount and of good kind, shreds of food remaining between the teeth cannot easily decompose; if, however, it contain in itself, as a result of an over-stimulation of its glands, many of the lining cells of those glands, it will, owing to the presence of these organic cells, tend itself to undergo decomposition, and will become acid, and favour any other decomposition in the mouth to which there may be a tendency. This acid state of the mouth is seen in bad cases of gastric derangement, in the course of severe fevers, and in that condition of the mouth in which thrush appears. What wonder, then, that the breath of the dyspeptic and of the fever-stricken becomes so offensive; and if the quantities of food so often injudiciously forced on them tend to aggravate the mischief!

In children who suffer from what will be later on described as catarrh of the stomach, the state of the mouth which results from the reflex effects of the stomachic derangement is often so bad that actual ulcerations are seen; and practical physicians know how difficult these are to cure, unless the condition of the stomach be rectified. A few doses of rhubarb and soda, and a restricted and simple diet, will, however, in the course of two or three days effect a cure, when local treatment has been for weeks without effective result. But not only does stimulation of the stomach lead to an excessive flow of imperfect saliva, irritation of the sciatic nerve and of some of the uterine nerves in woman will also, reflexly, induce the same state of matters. The salivation observed in pregnant woman, which occasionally gives rise to great trouble and uneasiness, and tends in itself to weaken the whole digestive function, is the result of pressure by the gravid womb on some one of the abdominal nerves.

DERANGEMENTS OF THE HUMAN SALIVA.

Hygienic treatment.—General principles are to be followed :—Simple food, exercise, fresh air, regular meal-times, and sufficient time for each meal. When food is taken, care and worry should, as far as possible, be banished from the mind; studying or the reading of any engrossing work at meal-times is also injudicious; but light pleasant conversation facilitates digestion.

Scientific Treatment.—The treatment should in almost every case be directed to the stomach. The bowels should be regulated by a simple aperient, containing, by preference, an alkali; such a powder as the following answers excellently for adults :—powdered rhubarb, 10grs.; bicarbonate of soda, 5grs.; trisnitrate of bismuth, 20grs.; oil of peppermint, 1 drop. It may be taken once or twice a day for two or three days, in any convenient fluid, and, though its taste is not agreeable, it will be found to have a peculiarly cleansing effect on the tongue, and but seldom to excite nausea. If local treatment be advisable, 30 drops of sal volatile, or as much bicarbonate of soda or powdered borax as will lie on a sixpenny-piece, in a wine-glassful of tepid water as a mouth-wash, may be used from once to many times a day, in accordance with the severity of the trouble.

I have now finished my short sketch of the commoner derangements which affect that part of primary digestion which is performed by the mouth. Before we proceed to disorders of the stomach, I will devote a few lines to the state of the throat and tongue.

THE AFFECTIONS OF THE THROAT.

The weak or relaxed throat.—This class of throat is not very common in a simple and uncomplicated form. Nearly all the so-called relaxed throats are cases of inflammation of the small muscles, and sometimes also of the tonsils in the throat. The people who suffer habitually from this throat-affection are those whose general vital power is from some temporary or persistent cause low, and who often only become aware of the unsatisfactory state of their general health when they find that, in speaking or singing much, they lack the *staying* powers that their friends enjoy. The symptoms that are most prominent are an inability to speak or sing for long without failure, and in some cases, loss, of voice, this failure usually being accompanied by a sense of pricking, uneasiness, or actual acute pain in the throat; sometimes a choking sensation is experienced. Nervous exhaustion always makes matters worse. Cough is usually present; it may be dry and short, or result in the expulsion of gelatinous-looking pieces of mucus. On examining the throat there is often not much that is visibly amiss. The uvula depends, and the whole back of the throat looks "flabby." In colour the throat is sometimes pale, but usually red or even purple from congestion.

Hygienic Treatment.—This is of the greatest importance. A change to a bracing, but not too keen, air, with perfect rest for body and mind, is usually the best measure, and often the only one which is of much avail. Any derangement of the bodily health should be specially sought for and attended to. Sometimes the stomach and liver are at fault; and I have known cases of relaxed throat, of very long standing, cured very quickly by a judicious attention to the functions of those two organs. But, as a rule, the whole system of the sufferer, the nervous portion of it in particular, will be found to be out of order. It may be laid down as a general rule in this complaint, that *general* and not local treatment is to be adopted.

Scientific Treatment.—Gargles and mouth-washes of all kinds are often urgently demanded by the sufferers; but little benefit must be expected from them.

I append one or two of the simplest and most useful formulæ:—

1. Tannin, 1dr.; brandy, a wineglassful. Shake up well, and add warm water up to a pint. Every few hours a mouthful should be taken, and kept at the back of the throat for a few seconds (not gargled) and then expectorated.

2. Common dinner-claret may be used in a similar manner.

3. One wineglassful of common port wine, the juice of four lemons, and water up to half a pint, in the same manner.

4. If the patient can brush his own throat, the following is useful: potassium-alum, free from iron, 1 dr.; glycerine, 6 dr. Dissolve by heat, and add tannin, 1 dr. To be applied thrice daily, with a brush, to the back of the throat.

5. As much tannin as will lie on half-a-crown may be dissolved in a wineglassful of boiling water, and allowed to cool. A few drops may, four or five times a day, be applied to the back of the throat by means of a spray.

The above formulæ are suitable for simple relaxed sore throat. If, however, there be any inflammation, the above will be too stimulating, and I should advise—

6. A tablespoonful of borax, or of chlorate of potassium, or of chlorate of sodium, to be dissolved in a pint of hot water, and used as a frequent gargle. A wet compress may with advantage be applied round the throat each night. The inhalation of the steam of boiling water is often serviceable, and a very cheap inhaler, suitable for the purpose, may be secured at any chemist's. Rest to the organs of the voice, and the avoidance of cold and damp, are necessary precautions for a few days.

7. Tablets of hydrochlorate of cocain, slowly sucked, give almost instant relief, in cases where pain is severe; each should contain 1-20th of a grain of cocain. One may be placed in the mouth every quarter of an hour for consecutive periods of three or four hours, if necessary.

Many persons, such as professional musicians, clergymen, and teachers, who are compelled to use their voices frequently, are severely hampered by throat-affections of this class. For such persons it is best to recommend a few lessons in elocution from some scientific teacher of that subject. In many cases, this throat affection is largely due to the methods of breathing when these people speak or sing, the breathing being shallow and subclavicular, instead of deep and abdominal, and to their want of deliberation—faults that can only be corrected by systematic teaching. It is, as a rule, the nervous excitable man, who breathes in a rapid and shallow manner, and who suffers most from the consequent strain on the muscles of his throat.

THE INFLAMED THROAT (ACUTE FORM).

This is either the result of the direct application of an irritant, such as cold or dust-laden air, or is reflexly produced by a disordered state of the stomach and liver, or is the outward expression of a general derangement of the system. The amount of inflammation varies widely : it may be slight, and due simply to cold, but may be, and often is, even if slight, extremely painful, especially when the act of swallowing has to be performed ; on the other hand, it may be extensive, and but slightly complained of. These latter cases are often due to stomach-derangement, the result of excess in eating or drinking ; and as it is the mucous membrane only of the throat that is then affected, the pain and discomfort are trivial. Again, the throat may be extremely swollen, and red as in erysipelas and scarlet fever, deeply ulcerated as in syphilis, or covered by the white deposit of diphtheria. These latter cases require the general treatment suitable to the complaints on which they depend.

Hygienic Treatment.—Rest, and very simple food ; warm air.

Scientific Treatment.—By far the most efficacious treatment in simple inflamed sore throat is the application of a stream of cold, or even iced, water constantly to the neck. This may be applied conveniently by means of properly shaped coils of fine lead piping, to be obtained of any instrument-maker. The apparatus costs but a few shillings, is easily worked, and lasts practically for ever. Ice to suck, and to swallow in small lumps, may be allowed *ad libitum*, and is exceedingly grateful to the patient. The practice of applying hot poultices to the throat, and of ordering hot gargles of borax and chlorate of potassium, and steam inhalations, is as a method of treatment very much less satisfactory than the treatment by cold. In simple inflamed sore throat, a smart purge is usually advisable, to be followed subsequently by aconite treatment; but I forbear, with such a potent drug as aconite to name any general dose.

CHRONIC INFLAMMATION OF THE THROAT.

This is a very common disorder, and the patient is often quite unaware of its presence. It is almost invariably the result of persistent inflammation of the mucous membrane of the throat or stomach, most commonly of both combined. It is sometimes associated with over-smoking, but is seen most commonly, and in the highest perfection, in the chronic drunkard. The look of the throat is dusky and turgid and the breath is generally offensive. A short husky cough, accompanied by that effort to clear the throat known as "hawking," is distinctive of this complaint. These attempts to clear the throat of the large amount of mucus which collects there, as a result of the chronic turgescence of the mucus-glands, and which condition is always worse after sleep, produces that "morning sickness" so common in persons who habitually exceed in their use of alcohol.

Treatment.—Always constitutional. Local treatment is useless; and as the throat is not, as a rule, painful, topical remedies are not solicited by the patient.

ENLARGEMENT OF THE TONSILS.

The acute variety of inflammation in these glands, known as quinsy, need not be described. There is, however, another less known variety, in which the small glands on the surface of the tonsils inflame, and pour out small white patches of secretion, popularly *known as ulcers of the throat.* They are, of course, not of the nature of ulcers, but are the expression in the throat of the presence of a poison, usually of a rheumatic or gouty nature, in the blood. I need only say that the warnings which they give should be attended to; for, if not read aright, rheumatic fever or gout may rapidly supervene.

CHRONIC ENLARGEMENT OF THE TONSILS.

This is of two kinds, rheumatic and scrofulous. The *rheumatic variety* is easy to distinguish from the other, because we have with it a history of chronic rheumatic affections or of frequently recurring acute attacks. Furthermore, the tonsils are smooth and their surfaces are not marked by the signs of ulceration, not are the tonsils ever actually honeycombed as in the scrofulous form.

The *treatment* is that suited for chronic rheumatism. These tonsils rarely require removal by the knife.

THE SCROFULOUS VARIETY.

This form makes itself evident very early in life—in fact, is often congenital. The tonsils are always enlarged, but not always painful; only so when they become inflamed, as they are apt to do. The child *snores* as a result of the impediment to breathing, and the general health suffers from the same cause.

Treatment.—The tonsils should be examined. General hygienic measures suitable to the scrofulous constitution, cod liver oil, sea air, &c., are, no doubt, all good in their way, but the effect is temporary only; and I speak from a very large experience, when I say that excision is the only satisfactory treatment. By a dexterous operator it may be carried out with perfect safety, and with very little pain to the patient.

THE TONGUE.

The tongue is very rarely the seat of inflammation. Often, however, it is the seat of ulceration, due, especially in children, to derangement of the stomach and bowels. After fifty years of age, and in men more than in women, the tongue is apt to be attacked by cancer, which commences as a small innocent-looking ulcer.

I will now briefly describe the different abnormal appearances of the tongue, which are due, as a rule, to the reflex action of a disordered stomach and liver, but which, in a small proportion of cases, do not bear that construction, but may be looked on as peculiar to the individual, and consistent in him with health.

Extreme Redness.—This condition mirrors a similar and co-existent state of the stomach and whole alimentary tract, and is produced by the same nervous mechanism which causes the red nose; indeed, it cannot be too claarly made known that the latter, which is vulgarly ascribed to the effects of drink, is merely an evidence of a species of chronic inflammation and irritation of the lining membrane of the stomach and bowels, reflected by means of the nervous system on the tongue; and though this may be, and often is, the result of alcoholic excess, it is by no means always or necessarily so. In the gouty, this redness of nose and tongue, and often of the cheeks also, is well marked, for in them great acidity of the stomach is common.

I show, by a simple diagram, the method in which the impression travels by the sensory nerve of the stomach, up to the two centres in the brain, and is reflected thence to the eye, nose, cheeks, salivary glands and tongue, causing dilatation of the blood-vessels in those regions. The impression conveyed by the nerve would, in a state of health, be only sufficient to reach centre No. 1, and to result in an increased flow of saliva; but when it is unnaturally strong, it travels on to No. 2, and produces flushing of the whole face and certain eye-symptoms.

Treatment.—Simple food, plain living, exercise, etc., and the treatment of any special condition, such as gout, which is producing the gastric and intestinal irritability.

IRREGULAR MARKINGS ON TONGUE.

The cross-barred state of the tongue, which is very marked in some people, is due to a form of chronic eczema, a skin-disease, which usually is itself the reflected result of old-standing stomach-derangement. Sometimes acute eczema attacks the tongue and renders it extremely painful. It generally, in the acute form, attacks the tip first, but may spread, subsequently, over the whole organ. The appearance it produces is one of great redness. No scabs are formed, as in eczema of the face; for the mouth, being always in a moist state, does not permit of much evaporation of the fluid which flows from the eczema, and which is the cause of a scab. Acute eczema of the tongue will sometimes persist for many years, and cause very great distress.

Ichthyosis, or fish-skin, is another not very rare skin-affection, which sometimes attacks the tongue. Well-marked scales are produced thereby. The disease is very intractable to treatment and not unfrequently ends in cancer.

Treatment.—I can give but one hint as to treatment. This should be directed to the setting, and keeping in order, of the stomach and bowels; without which, no local treatment will be of slightest avail.

FUR ON THE TONGUE.

This may be produced by causes acting locally—decayed teeth enlarged tonsils, the habit of smoking, etc., but is most commonly due, like the other appearances of the tongue which I have described, to nerve-reflection from the stomach and bowels. The following are the commoner varieties of furred tongue, and the conditions they are supposed to indicate :—

a. A large flabby pale tongue, with a light coat of fur, indicates a generally relaxed state of the individual's health. Mild aperients, followed by a generally tonic course, bracing air, out-door exercise, nux vomica, etc., are usually of most service; but everything depends on age and the general surroundings of the patient.

b. A pale tongue, with air-bubbles at tip and edges, is held to indicate a specially weakened condition of the nervous system, and is associated often with morbid fears, hysteria etc.

c. A tongue thickly and universally covered with creamy fur, tinged with yellow or brown.—This is an indication of a recent acute and severe derangement of the stomach and bowels, accompanied by a block in the portal circulation through the liver. We shall consider this state in dealing with acute gastric inflammatory catarrh. It is often the result of great excesses in food and drink. The indications for treatment are an extremely low and simple diet, and a mild purge, followed by soothing remedies to calm the state of the stomach.

d. In this species of furred tongue, *the organ is covered with a much drier and usually a much browner fur* than in the form which I have just described. Altogether, the impression conveyed by an inspection of it is that the fur has been there a long time; and this supposition often leads to a correct diagnosis. Such a tongue is only coincident with a *chronic* state of inflammation of the lining of the stomach and bowels, and is an evidence of what is called chronic inflammatory catarrh of the stomach. Such a condition generally results from a constant and gross excess in diet, usually from chronic alcoholism.

(*e*) Finally, *a trembling tongue* is always an evidence of severe nervous disorder. It is seen in cases of chronic alcoholism, and often confirms the diagnosis of that condition ; but it may also be proof of nervous disorganization not the result of alcohol.

CHAPTER VII.

PRIMARY INDIGESTION, *continued*.—A. INFLAMMATORY STATES OF STOMACH.

THE structure and functions of the human stomach are, on the whole, more simple and intelligible than those of the mouth. As we have seen in an earlier chapter, the stomach consists of a simple bag, with an inlet and an outlet. Its transverse measurements are, roughly speaking, about 12 inches, those from above downwards about 4 inches. Even in a state of health, however, these measurements are, in proportion to the amount of food, gas, etc., contained in the organ, subject to constant variation, whilst the normal size may be doubled and almost trebled as the result of constrictive disease affecting the outlet.

When we consider that the quantity of food at one time in the stomach varies widely at different periods of the day, and that *all* forms of food are retained by it, in health, for periods varying from half an hour to four or five hours, or even longer, the necessity for this great adaptability to circumstances becomes apparent.

The walls, as we have already seen, consist of four layers of material, the innermost of which alone provides the digestive fluid and some mucus; the next subserves mainly the purpose of padding and the conveyance of the larger blood-vessels and nerves; the third, by its muscular fibres, imparts contractility to the organ; and the fourth or outer one acts as a general support to the other three.

The digestive fluid prepared by the stomach, and which, in a state of health, *is only poured out by it when its surface is stimulated by the presence of food*, consists of an admixture of the ferment called pepsin with an inorganic acid, hydrochloric acid,—and as these two are, with the exception of a small portion of the stomach adjoining the outlet, always secreted together, and inert when separated, they are, for the sake of convenience, and with the view of conveying to the mind a correct idea of their composition, best described by one name—pepto-hydrochloric acid.

The function of the stomach is limited to the digestion of albumens. This point must be clearly grasped, as it is popularly little appreciated or understood. Now the foods which are most rich in albuminoids are those necessarily which contain most protoplasm; for protoplasm is but living albumen, and comprises a large proportion of the flesh of all animals and of the seeds of all plants; eggs and milk, with their derivatives, cheese, koumiss, etc., being animal compounds, are also rich in them. Beyond this power over albumens, gastric digestion does not concern itself, and, as far as the fats and starches are concerned, the stomach fulfils the part merely of *a receptacle.* Its walls, however, absorb grape-sugar, formed in the mouth from starch, and swallowed; for the mouth itself has no absorptive power, strictly speaking, over foods, and the stomach-walls also in health, imbibe all, or most of, the water swallowed in various beverages—beer, soup, milk, etc., as well as nearly all salts consumed with food.

Now let us sum up these functions :—The stomach in health *digests* albumens, turning them into peptones which are absorbed at once by its walls ; it also *absorbs*, but does not digest, grape-sugar, water, and salts. Such are its most important functions, and they must be kept in mind, as upon them depend many of the symptoms which become painfully conspicuous in the different forms of indigestion that affect this organ. Finally, the reflex effects of a disordered stomach on the mouth, saliva, and teeth, already referred to, must be remembered.

The derangements of the stomach may be divided into four great classes :—

1. *Inflammations and congestions of its surface.*—These are acute or chronic, and cover many of the conditions upon which depend what are commonly called biliousnes, severe indigestion, dyspepsia, used in a general sense, sick headache and bilious fever. This state is characterised by *a redness of the organ*, *the constant over-supply of blood* being productive of a red and inflamed appearance.

2. *Loss of power of the stomach.*—This condition, known as weak digestion or atonic dyspepsia, is the reverse of the inflammatory variety, and is marked by an *unnaturalpallor* of the organ, due to a *deficiency of blood*, owing either to a general want of blood on the part of the patient, or to an unnatural deflection of too large a portion to some distant organ, *e.g.*, the brain, etc. This is the dyspepsia of the student, the brain-worker, the worried man, the individual who has in any way over-exerted himself, the poor and starving, the aged, the debilitated, and the convalescent from severe febrile disorder.

3. *Functional derangement of the stomach.*—This comprises a whole group of symptons, due to various causes and conditions, and agreeing but in this, that they do not, in themselves, indicate any special known derangement of the stomach or its blood and nerve supply. This condition of matters is due to some *temporary* disorder, not perhaps easily traced to fault in either the organ or the food supplied to it, and yet distinctly real, and very disagreeable to the patient.

This class is inserted here to cover the *terra incognita* of gastric derangement, not at the present day such a large tract of country, but one still which must be taken into account. Strictly speaking, it cannot perhaps be ranked as a class of stomach derangement at all, being merely a group of ill-assorted symptoms. It comprises the different parasitic disorders, neuralgias of the stomach, acidity and flatus in some of their forms, sensations in the stomach of various kinds, such as sinking, burning, coldness, heartburn, etc.

4. *Organic disease*, *i.e.*, *degeneration* and decay of stomach. Examples of this form are seen in cancer, ulcer, chronic thickening, etc., of the organ.

ACUTE INFLAMMATORY DYSPEPSIA
(confined to the stomach).

This form of dyspepsia is known as acute gastric catarrh. It is often incorrectly spoken of as, or confounded with, biliousness, bilious or gastric fever, and inflammation of the stomach.

Condition.—The blood-flow to the stomach is increased, and results in an excessive and *constant* secretion of a badly formed gastric juice and of mucus, which latter substance is prone to undergo decomposition. The normal movements of the stomach are much increased by the irritation of its acid contents and pain is produced. The amount of disturbance is proportioned to the causes, of which there are two.

1st. *Over-taxation of the stomach when it is in a weak state.*—The over-feeding of infants, of the young, of the convalescent, and of the aged, leads to this form of indigestion. It is a very common disorder in infancy, when, owing to the elasticity of the cells of the body, the rebound of any organ in contact with opposing forces is rapid and marked. The attacks in early life are therefore severe, and may lead to convulsions and even to death. In convalescence from fevers it is no uncommon thing for the same form of indigestion to be set up. In old age the symptoms, as a rule, are not well marked.

2nd. *Over-taxation of the healthy stomach.*—Sometimes from an excess of food, but much oftener from an injudicious consumption of alcohol. In adults, nineteen out of twenty cases of this disorder are directly traceable to the latter cause. Various poisons, especially the gouty poison, strongly predispose to an attack.

Symptoms.—These are of two kinds—the early and the later.

The early symptoms vary with the age of the individual, his strength, and the cause of the attack. *In infancy and early life*, vomiting of an incessant kind, often accompanied by purging, and attended with high fever, and an incapacity to retain food of any kind on the stomach, are usually the first indications. Severe convulsions and delirium are not unfrequent concomitants. The fever is always high. In *adult life*, tenderness or pain over the stomach, an intolerance of the stomach for food, and a desire for cold drinks are three invariable symptoms. The amount of tenderness varies; in some it is represented by acute pain; in others it is only experienced on pressure. Vomiting, and a distaste for food, combined with inability to retain it, are always present to some extent, as is the constant desire for cool drinks, though this latter symptom is not of such constant occurrence as the former ones. Fever is moderate. In *old age*, the symptoms on the whole resemble those at middle life, but faintness, palpitation, and vertigo, due largely to an inability of the heart and general system to stand the abstraction of blood by the walls of the stomach, are often present, and produce great alarm. The tongue in all cases is thickly coated. Other, occasional, symptoms are shivering and aching in the back, headache, dimness of vision, a short dry cough, flatulence, mental anxiety, and constipation, or, more rarely, diarrhœa.

The *later symptoms* come on in the course of a day or two. These are less urgent than, but bear a general resemblance to, the earlier ones. The vomiting, pain, and thirst are less; but the intolerance of the stomach for food is still marked.

The duration of an attack.—This varies with the individual, the cause, and the line of treatment adopted. A young man will often in twenty-four hours be fairly well, but, as a general rule, it may be said, that complete health is not regained for a week at least, and sometimes, owing to misinterpretation of the symptoms in the very young, in the aged, or in the feeble generally, health is never restored. In manhood recovery in from four to seven days may be expected under judicious treatment. In old age the effects of an attack last often for weeks and months,—in fact, may gradually pass into those of the intractable chronic stage, to which we will now proceed.

CHRONIC INFLAMMATORY DYSPEPSIA,
(confined to the stomach).

Chronic gastric catarrh is the synonym of this malady.

Causes.—Everything that conduces to the acute form, when long continued, acts, of necessity, as a producer of the chronic form, and therefore the systematic overtaxing of a weak stomach, and the persistent and gross mismanagement of a healthy one, are both among the more frequent causes. But we have in chronic stomach derangement a third and not infrequent cause, namely, chronic blood-derangement, such as we see in Bright's disease, in diabetes, in chronic gout and rheumatism, in malarial affections, in consumption, in scrofula, etc.

In this, the chronic, form, the *structure of the stomach* becomes profoundly altered. The constant over-supply of blood to the part, leads, at first, to an increased and constant secretion of gastric juice, and at the same time, to a great increase in the connective tissue, which not only binds the different layers composing the stomach-wall together, but sends processes up to support the glands that prepare gastric juice. Now the growth of all connective tissue has its limit, and when this is reached its vital or growing energy becomes exhausted and degeneration and *shrinking* follow. Gradually, as a result of this shrinking, the glands that prepare the digestive fluid become strangled, and incapable of fulfilling their function. The mucus-glands largely escape this process, owing to the fact that the connective tissue does not, to the same extent, envelop them, and they continue to pour out large, if somewhat abated, quantities of mucus. The blood-vessels, nerves, and lymphatics also gradually come under the influence of this contraction, and thus the symptoms of hunger, and the powers of digesting and absorbing foods, are largely lost. Thirst is, however, present, since it does not depend so much on the state of the stomach as does hunger, though even hunger itself is a demand more of *the whole system* than of the stomach, for food.

If, therefore, we examine the stomach of an individual who has died while suffering from this form of stomach derangement, we see, in place of a clear, smooth, pinkish, organ, one whose surface is covered with a quantity of dirty-grey and very offensive sticky mucus, with which any solid food that may recently have been taken, is coated.

The *symptoms* may be almost guessed from what I have said. The tongue is always coated, the saliva copious, but inert and tending to decompose, the throat congested, the eyes turgid, the nose and cheeks often inflamed. To such reflex symptoms we must add those specially appertaining to the stomach—want of wholesome appetite, an inability to taste or to digest any but very stimulating food, the stomach having lost its powers of reaction to normal stimulation. A desire for fluids, a chronic state of irritability and restlessness, altered action of the heart, development of much flatus, a tendency to sickness in the morning, and the ejection then of much mucus, and disturbed rest at night, are other common symptoms. Pain over the stomach is rarely complained of, but uneasy sensations of sinking, and of nausea, are common. Food produces marked discomfort, which, however, is often more severe in the back and under the shoulder-blades than in front and over the stomach. Sometimes the taking of food, and, nearly always the drinking of alcohol, will relieve, for a time, the uneasiness in the stomach. Vomiting, with the exception of the morning sickness already referred to, is not a prominent symptom; the nervous sensitiveness of the stomach being too dull to induce this act. Thirst is marked, and it is often remarkable what a vast amount of fluid such a patient will consume. Sufferers from this form of complaint may drink from 2 up to 15 or even 20 quarts of fluid in the course of a day. They are *always thirsty.* This is quite a characteristic trait, and yet the sensation may, perhaps, be described better as one of internal heat and languor, than of ordinary thirst. The breath is offensive; the tongue covered with a fur, usually of a brownish hue, and the papillæ at its base are enlarged and prominent; the gums are spongy, and tend to bleed; the lips are usually dry.

The excreta from the bowels are offensive; irregular attacks of diarrhœa are frequent. Hæmorrhoids (piles) are not uncommon.

Symptoms not so frequently present as the preceding ones, are, dryness of the skin, with tendency to skin-affections, a yellow tinge in the white of the eyes, headache, vertigo, and coldness of the hands and feet. Loss of flesh is gradual, and, from the fact that the sufferer often consumes large quantities of beer, not so marked and prominent as might he expected. A tendency to suffer from bronchitis, pleurisy, inflammation of lungs, etc., on very slight exposure, is always present, and one of these diseases is often the final cause of death. Chronic gastric indigestion, of the form I have described, reaches its highest perfection in the person of the chronic drunkard.

I shall, in this instance, depart from my customary division of all *treatment* into hygienic and scientific, as the two are very closely blended in the disease which we are now considering.

Treatment of the acute inflammatory derangement.—This consists in wisely following in the wake of nature. By the aid of her symptoms she seeks to effect the three following ends:—1, removal of the cause of the disorder; 2, the resting of the inflamed organ; 3, the soothing of the inflamed organ.

Removal of Cause.—By means of vomiting nature seeks to eject the excess of undigested food, or of material forced on it by unwise efforts. Such as has already passed the outlet of the stomach, and cannot be assimilated by the bowel, she rids the system of by diarrhœa. The artificial induction of vomiting, and the administration of a purgative, seem then to be the first steps we should adopt in cases where we have reason to believe that offending substances are still lodged in some part of the intestinal track. As an emetic for the robust, a couple of tumblers of warm water, with or without the addition of a teaspoonful of salt to each, and followed by the tickling of the back of the throat with the finger or a feather, is perhaps the best and simplest form to recommend. For children, a teaspoonful of ipecacuanha wine in a little sweetened water, administered every quarter-hour till either sickness has been produced, or four doses have been taken, is a good method. If the four teaspoonsful fail to act, it is better to discontinue the use of the remedy, which will probably produce some action of the bowels and thus effect an equally useful purpose.

One or two hours after vomiting, or at once in cases where we have reason to think that the stomach contains no irritant material, an aperient may be administered to the patient. One mild in action must be selected, or more harm than good may result. Castor oil is, doubtless, the one most suited, but its offensive taste, a taste that cannot be effectually disguised, acts as a bar to its administration. For adults, some one of the following; a Tamar Indien lozenge, a large teaspoonful of confection of senna, a couple of compound rhubarb pills, one ounce of the old-fashioned black draught, a teaspoonful of compound liquorice powder, or a full dose of citrate of magnesia, will, as a rule, suffice, and the dose may be repeated, if required, in twelve hours. In very robust individuals, however, in whom symptoms of approaching high fever are manifest, more active measures are often required; and one of the following doses, to be followed in six hours by a seidlitz powder, or by an ounce and a half of black draught, may be substituted for the milder measures above recommended:—

Podophyllin, ½ grain; calomel, 1 grain; extract of henbane, 2 grains. To be made into a pill, and taken at once. Or :—Iridin, 4 grains ; euonymin, 1½ grain ; extract of henbane, 2 grains. Divide into two pills ; both to be taken at once. The last-named pills are particularly effective, and do not cause griping. Two of the old-fashioned blue pills, followed in six hours by a black draught, is another course which in some persons yields good results.

For children, one or two teaspoonfuls of castor oil, or a teaspoonful or more of the sweet extract of senna, or three grains of calomel placed on the tongue, act as suitable laxatives.

In large families, where, now and again it becomes necessary to administer a mild purgative, I have found the following mixture useful. The addition of the brandy facilitates its keeping :—

Powdered gum acacia, syrup, glycerine, of each ½ ounce ; water, 1½ ounce ; castor oil (tasteless), 4½ ounces ; extract of vanilla, 1½ drachm ; brandy, two teaspoonfuls ; oil of cinnamon, 8 drops.

The mixture contains about half its weight of castor oil, and therefore the dose to be administered should be about double that of plain castor oil. I need scarcely say that the above recipe requires to be made up by a chemist, in order that each item may be properly incorporated, and a sightly and palatable medicine result.

Rest the inflamed Organ.—The sufferer has no desire for food, merely wishing to be supplied with cold fluids. Let us in this, also, follow nature's lead. We cannot put the stomach, as we might an injured arm, in a sling ; but we can do what practically amounts to the same kind of thing,—we can relieve it of much of its usual work. In the worst class of cases, no food whatever except, perhaps, a little gum water or water gruel, should be given in the first twenty-four or forty-eight hours. During that time, ice may be allowed freely, and will assist greatly in assuaging thirst. If the patient be robust,—and the worst class of cases are found in the strongest men,—this semi-starvation alone will do a considerable amount of good, and, by the second or third day, one of Benger's or Carnrick's preparations of peptonised or pancreatised beef may be administered. If not objected to, buttermilk forms, at this stage, a most excellent and nourishing beverage. It has the advantage of being easily retained. Peptonised milk may be administered with caution ; or boiled milk, that has cooled, may be given with soda, or Vichy, or Pullna, water ; but plain unboiled milk is to be forbidden, as the curd formed by it in the stomach is likely to cause irritation. Chicken or veal broth, with some thickening of a floury nature, is also very useful. Malted milk foods, without eggs or sugar, are also well borne ; and even plain extract of malt, given in teaspoonful doses, as a drink, beaten up in water, is a useful nourishment, and one that agrees well. Loeflund's Kindermilch and his Cremor Hordeatus, may also be recommended, though few patients can stand their extreme sweetness. Milk and farinaceous soups are also useful ; and good sound ripe fruit may be allowed in small quantities. One word of warning applicable to all sickness ; the food should be prepared out of the sick-room, and should be brought to the patient in small quantities, well cooked, nicely flavoured, and as daintily served up as possible. If not eaten, it should be removed at once, and should not again re-appear

In infancy it is especially necessary to select none but the simplest and most digestible articles. They may be given in small quantities and frequently ; for, in this complaint, gastric juice is pretty equally present in the stomach, all day long, whether food be consumed or not. Milk will have to be given even in the first twenty-four hours of the attack, if the child be under two years. In such a case, it should be boiled, diluted with an equal part, or even more, of water, and have some alkaline addition. If constipation be present, as much bicarbonate of soda as will lie on a sixpence, or as much magnesia as will lie on a half-crown, or a teaspoonful of fluid magnesia may be added to each half-pint of milk and water, but if diarrhœa be present, *freshly made* lime-water,* *four to six tablespoonsful*, or one teaspoonful of prepaired chalk, may be substituted.

In the adult, after the first four or five days have elapsed, there is usually apparent a strong tendency to have recourse to solid foods. It is well to avoid these for the first week ; but if the patient be progressing favourably, or the attack be mild, or he exhibit an invincible dislike to liquid foods, a few oysters, or a little steamed or boiled white fish, may be allowed. Game or poultry may follow in a day or two. Ripe fruits, either uncooked or stewed, and served with milk or cream, are also admissible. Vegetables, except asparagus, seakale, or young turnips and carrots, are as a rule best avoided. The patient should, however, be given to understand, that, however well he may be able to digest these articles of diet, he will have to be exceedingly cautious for a time, and that the following articles are for some time to be avoided:—re-cooked meats, salted and pickled meats, pastry, cheese, and all vegetables not mentioned above, especially those belonging to the cabbage tribe. Eggs are also often included with wisdom in this list. Coffee and tea are best avoided during the first week of illness.

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* Smaller quantities of lime water than the above are of no real avail.

Enemata.—A great deal is often said about feeding by the bowel in cases where the stomach does not tolerate food. I wish to say a few words on the point. In the first place, the idea is very naturally repugnant to the patient; in the second, it is not suitable in the case of children, who are much frightened by the process; in the third place, it must be carried out by the medical man himself; and, lastly, it is of very little real service in any case. My conclusion is founded on the following consideration,—namely, that the powers of absorption possessed by the lower bowel are very slight, and, for the process of injection to be really efficacious as a nutritive method, the food used must be made to penetrate from two to six feet—an object, that is, *experto crede*, very difficult to accomplish. When this method, however, is deemed desirable, the following are the injections that I can most confidently recommend:—

1. Four tablespoonsful of Benger's peptonised beef and ten tablespoonfuls of whey.
2. Two tablespoonfuls of Loeflung's Kindermilch and half a pint of whey.
3. Half a pint of peptonised milk.
4. Half a pint of peptonised gruel.

The injection used should be warmed to a heat about equal to that of the body, and the bowel should be previously emptied by means of warm water. The injections may be used twice or thrice daily, and five to ten drops of laudanum may, but of course only in adults, be added to each. This addition seems to assist the retention of the food, and prevent or lessen the pain and discomfort which often continue for one or two hours after the process of injecting has been carried out.

The question of the use of alcoholic stimulants in the treatment of this form of derangement of the stomach very frequently presents itself to the notice of the medical man. I may say once for all, that all forms of alcoholic stimulants should if possible, be banished from the dietary. Still, as, in some of their forms, they possess very distinct nutritive virtues, their use is occasionally permissible. The kind and amount to be administered will depend upon the peculiarities of the case; but, as a rule, good white bordeaux or burgundy, well-kept hock, or a very minute quantity of brandy, in potash, soda, or seltzer water, are the best forms. Sweet wines must of course be avoided.

If the cause of the attack be, however, traceable to alcoholic indulgence, the physician will be performing his duty in strongly cautioning the patient against all forms of alcohol. In the case of the old *habitué*, whose will-power has long been broken, such words will, no doubt, be wasted; but there are many young people on whom they will produce a good result, if they be spoken in a manly and friendly spirit.

To soothe the inflamed stomach must be our third and last endeavour. It may be thought that nature does nothing towards the fulfilment of this indication. But the pouring out of mucus, one of the earliest symptoms of acute gastric derangement, effects this purpose well. If the general health be otherwise fair, this secretion of mucus does not, in this disorder, lead to any mischievous result; it is only when food unsuited to the powers of the stomach, is unwisely forced on the patient, or when the surface of the organ is constantly kept in a state of irritation from alcoholic beverages, that it becomes so excessive in amount that it cannot be reabsorbed, and decomposes.

We can, however, assist, and I believe to a very considerable extent, this soothing effect naturally produced by mucus, and or that purpose we possess a drug which from its remarkable powers of allaying irritation, from its insolubility in the saliva, and from its absolute safety, stands unsurpassed. I refer to bismuth, and especially to the trisnitrate and oxychloride of bismuth. Being tasteless—for all things that are insoluble in the saliva are, of necessity, tasteless—bismuth has the advantage of not exciting any train of ideas in the patient's mind that can lead to nausea. It may be given with equal safety to children and adults, but it is with the latter that we obtain the best results. The dose varies from 30 grains to a drachm. It may be given as a powder, suspended in gruel or barley-water, for, being both heavy and insoluble, it cannot well be administered in plain water, as it falls rapidly to the bottom. The other preparations of bismuth, the oxide, the carbonate, and the ammonio-citrate of bismuth, are inferior in power as sedatives. I append two useful recipes:—

For adults:—

Oxychloride of bismuth, ½oz.; glycerine, ½oz.; compound tragacanth powder, 1dr.; bicarbonate of soda, ½dr.; water up to 8oz. An eighth part, in water, to be taken every three or four hours.

For children:—

Trisnitrate of bismuth, ½oz.; carbonate of magnesia, ¼dr.; compound of tragacanth powder, 1½dr.; glycerine, 1oz.; water up to 2oz. One teaspoonful every three or four hours.

A drug only second to bismuth in usefulness in chronic inflammations of the mucous membrane, is opium. There are many persons who will inform the doctor that opium in any shape or form is an abomination to them. Such persons are usually very ignorant of the manufacture, the varieties, and the uses of this drug. I know of no system of medicine, in any civilised country, that ignores the use of it. At the same time, in proportion to its great power and utility, must be the discrimination with which it is used. In the treatment of the complaint which we are now considering, opium holds a very high place. For adults it may be prescribed in various modes of combination. One single dose of one-third of a grain of morphia, inserted beneath the skin, by means of a subcutaneous syringe, will, without any further need for medication, in many cases arrest the urgent symptoms and give the patient complete ease, banishing, almost at once, sickness and nausea. If not given in the form of morphia, it is, as a rule, best administered as extract of opium; one-third to one-half of a grain of which, as a pill, every four or six hours, usually suffices.

In the case of children it must be ordered with the greatest caution, as they are very susceptible to its influence; in fact, I think the only form in which it may with safety and convenience be administered to them is in that of Dover's powder, which contains about ten per cent. of powdered opium. In such a form I prescribe it in infancy, thus:—

Dover's powder, ¼gr.; white sugar, 2grs. Make twelve such powders. One to be placed on the tongue every three hours.

Alkalies, such as the bicarbonates of sodium or of potassium or the citrate of potassium or of magnesium, are useful in checking acidity.

Acids.—The mineral acids in small quantities, highly diluted, are sometimes of use, but the only one of them from the administration of which I have ever observed much benefit is diluted sulphuric acid. This possesses a marked power of allaying many forms of stomach distress, especially when these are associated with vomiting. It may be administered as follows:—

Dilute aromatic sulphuric acid, 2drs.; cherry laurel water, 1 drachm, caraway water, 8oz. An eighth part to be taken in water every three hours till the symptoms ameliorate.

The last chemical agent of which I shall speak in this connection is carbonic acid gas. This gas, that which bubbles up in our effervescing drinks, has, as is popularly known and appreciated, a remarkably sedative effect on a stomach in a state of unrest. If advisable to make use of its sedative effects in medicine, it may conveniently be prescribed, in conjunction with bismuth, thus:—

Oxychloride of bismuth, ½oz.; glycerine 1oz.; bicarbonate of sodium, 2½drs; orange-flower water, 8ozs. One-eighth part to be poured into a small tumbler, and one small tablespoonful of lemon juice, with four tablespoonfuls of water, to be added; the whole to be drunk while effervescing. A powder containing fifteen grains of citric acid, dissolved in four tablespoonfuls of water, may be substituted for the lemon juice.

The above is an excellent combination, rarely failing to soothe an irritable stomach.

Now for a few general directions. In all severe cases the patient should go to bed at once in a well-aired room, of which the temperature should not exceed 60° Fahr. If feverish, the bed-covering should be light, and the whole surface of the body should be sponged twice a day with tepid water. In place of the sponging, and if the patient's strength permit of it, and there be no irregularity of the heart's action, a *hot* bath may be taken with advantage once a day. From ten to fifteen minutes is long enough to remain in the bath, which should be taken in the bedroom. In addition to the rest in bed, in most cases it will be advisable to adopt some means of giving local relief to the pain in the region of the stomach; nothing answers this end so thoroughly as a well-made poultice. The following directions for making an efficient poultice, I copy from a popular work on household matters :—

Make a flannel bag, varying from eight to fifteen inches in length and from four to eight inches in breadth, extending one side slightly beyond the other, so as to form a flap, like a postman's bag. The crushed linseed meal is now prepared with *boiling* water, and made thin, so that it will readily pour out. It is poured, whilst at almost boiling heat, into the bag, the flap of which is folded over and secured by safety pins or a few stitches. The bag is wrapped in one or more folds of flannel and applied to the seat of pain. Such a poultice, which, on account of the folds of flannel in which it is enveloped, is not too hot when first applied, retains warmth for several hours. Bags of hot salt or of hot bran may be used as substitutes for the above.

In the treatment of chronic inflammatory derangement of the stomach (chronic gastric catarrh), it will, as a rule, be found that the patient who is well enough to get about, and to transact the ordinary business of life, as the subjects of this form of complaint often are, will not willingly submit to any rules of restraint. Three conditions should, as far as possible, be secured: good hygienic surroundings; a regulated and simple dietary and great caution in the use of alcohol.

As for the hygienic conditions, these should consist in plentiful out-door exercise, a strict attention to cleanliness, secured by a daily tepid and a monthly Turkish bath, unless there be some special reason why this latter form of bath should be avoided, the wearing, next the skin, of flannel, or, where the skin is irritable, of Dr. Lahmann's Baumwoll garments, plenty of fresh air at night in a well-aired, but not a cold and draughty, bedroom, and a life well regulated both as regards business and pleasure.

Diet.—This point is of great importance. The object to be attained being to save the stomach from much work, albumens in excess of the body-need should be avoided. Unfortunately, we cannot determine in every case the actual amount required, much depending on exercise, temperature, constitution, age, and even idiosyncrasy.

It is a fact, established clearly in practice, though so far unsupported by strict scientific experiment, and therefore sometimes denied, that vegetable albumens are far more easily digested than those derived from the animal world, though the latter are, by virtue of certain ingredients (notably kreatinin), more stimulating, and impart to the consumer a feeling of satisfaction not to be derived from the consumption of grain and seed food. The vegetable world, therefore, rather than the animal, should be drawn on for the nourishment of the chronic dyspeptic.

Oatmeal or wheatmeal porridge and milk, bread and milk, hominy, toast and butter, and fruit, are the best kinds of foods for breakfast. As beverages, tea or coffee, with plenty of milk, cocotina, cocoa, or a light white wine, with abundance of water, are the most suitable.

The midday meal should be light. A plate of white bait, if in season, with some brown bread and butter, or half-a-dozen oysters, or a few sandwiches, with one or two glasses of claret, will suffice, if the patient be a busy city man; but if he be idle, or his occupation be sedentary, a slice or two of brown bread and butter, or a few brown biscuits and a cup of coffee, will make a still better luncheon.

The principal meal should be taken when the toil of the day has been completed. For this, well-cooked beef or mutton, poultry, game, or fish, as a first course, followed by a vegetable entrée, a light milk pudding (though this is often best avoided), with plenty of fruit, excepting nuts, to follow, will amply suffice for all his needs. A few glasses of claret, with plain, or aerated table water, such as Eau de St. Galmier, Eau de César, etc., make a suitable beverage.

If any supper be needed—and some people cannot sleep unless they take something before they retire—a cup of cocoa and a few biscuits will suffice.

Alcohol should be avoided, except in the form of a light natural wine, and that diluted, and taken with meals only.

Drugs.—From time to time the patient will probably require physic. When the stomach threatens an acute attack—and all chronic dyspeptics of this kind are subject from time to time to visitations of the acute form—there is, in my experience, no medicine that excels the following:—

Trisnitrate of bismuth, 30grs.; powdered rhubarb, 15grs. to 30grs.; bicarbonate of soda, 5 to 15grs.; oil of spearmint 2 drops.

Such a powder may be taken in water for two or three nights in succession, whenever acid eructations, and the development of troublesome flatulence, warn the patient that fermentation of surplus food and of mucus is proceeding in his stomach and bowels.

For the distressing morning sickness, as much trisnitrate of bismuth as will lie heaped upon a sixpence, may be taken in a little milk, or soda-water, three times a day; but this very troublesome symptom will usually improve of its own accord on the adoption of a temperate and rational mode of life.

Patients are often urgent in their demand for tonics. These are, as a rule, not advisable in this complaint, where the appetite keeps pace, as it does, in nearly all diseases, with the powers of digestion. Still, now and again it may be advisable to afford some help to the taking of food, and then the following simple formula will be found invaluable:—

Bicarbonate of potash, 80 grains; tincture of cayenne, 24 drops; infusion of quassia, to 8oz. One-eighth part thrice daily, just before food.

Finally, for the wealthy, especially if they be tainted with gout, change of air and scene, early rising, and a simple dietary, with a sufficiency of out-door exercise, are often necessary for the completion of a cure. But, to obtain those benefits, it becomes frequently necessary to dissociate the invalid from his surroundings. A visit to a watering place, and a course of the waters, are, in such cases, a wise recommendation. In England, Malvern, Cheltenham, Leamington, Harrogate, and Scarborough may be mentioned. On the Continent, Carlsbad, Marienbad, Seidlitz, Franzensbad, Pullna, Kissingen, Friedrichshall, or Ems may be visited. Each of the above places possesses certain special advantages of its own, suitable to individual cases, and the final selection should be left to the medical man most conversant with the patient's family, and personal history, and his financial resources.

CHAPTER VIII.

PRIMARY INDIGESTION (*continued*).

DEBILITY OF STOMACH.

Synonyms: weak digestion, irritable dyspepsia, atonic dyspepsia.—This condition is exactly the reverse of that which we have just had under consideration. In the acute and chronic inflammatory forms, the derangement of digestive function was due to an *increased blood supply*, the direct result of a temporary or constant over-stimulation of the organ; in the atonic form, a *deficient* blood-supply, leading to so-called deficient tone, and due to the persistence of some cause or causes which rob the stomach of its normal supply of that all-necessary fluid, is the great characteristic. This dyspepsia is often appropriately styled *atonic*; for an organ that lacks blood, equally lacks tone. Yet another name, that of irritable dyspepsia, is sometimes bestowed on it. A weak, bloodless stomach, like a weak, bloodless man, is always irritable; simple articles of diet in the former, and small and insignificant troubles in the latter, induce distress and worry out of all proportion to the causes. This weak condition of the stomach is common in people who are most scrupulously careful about their diet, in the aged and in the delicate, in those especially of the female sex, who do not take muscular exercise, and whose whole system is atonic. Amongst men those most prone to suffer from it are such as lead studious, sedentary, lives. In the case of the women, the stomach is simply bloodless, because the whole body is in that state; in that of the men, a persistently over-gorged state of the brain robs of its legitimate supply the rest of the body, the stomach included, to which latter organ, equally with the brain, a good supply of blood is an essential condition to good work.

Most of us have had some experience of atonic dyspepsia and its unpleasant results. Our brains have been active with scientific problems, with business matters, or with domestic cares and worries; in that condition we have sat down to take food, and have soon become conscious that our digestive faculty has suffered from the preoccupation of our minds. For this reason, reading is, as a rule, to be discouraged at meal-times; but pleasant conversation, by distracting the mind from the contemplation of trouble, with which it might otherwise occupy itself, is to be encouraged. In the same way, the listening to music, or to the reading of some light interesting work, promotes digestion, for they are just exciting enough to maintain a brisk circulation in the brain, and thus assist in maintaining in good working order those parts of the brain, the so-called centres, which preside over and regulate the digestive act. Hence the old adage, "Laugh and grow fat." Hence also, doubtless, the origin of the ancient custom of keeping the jester hard at work during the feasts of our ancestors, and the more recent custom of toasts, sentiments, and songs. As, therefore, inflammatory gastric dyspepsia is the Nemesis of the *bon vivant*, the glutton and the drunkard, so weak or atonic dyspepsia is that of the man of science, the brain-worker, the feeble, and the aged.

In childhood, however, atonic dyspepsia is far from being uncommon. It is seen often in a typical form in children born in India, or of parents who have long resided in tropical climates. It is also, as one might expect, exceedingly common in the offspring of those who have long been residents of large towns. Strange to say, the physician is but rarely called on to prescribe for this condition in childhood. Debility of the stomach and of the abdominal organs is a condition not readily recognised by parents and nurses, who, when they find the appetites of their young charges flag, seek to force on the weakened organs foods in nature and in amount ill proportioned to the digestive power, under the erroneous impression that such a course will strengthen the children. The medical man is therefore more often summoned to advise on the treatment of the resulting inflammatory or congestive disorder, rather than on the condition of weakness that underlies it.

In the matter of treatment, as I observed in my last chapter, the subjects of inflammatory gastric dyspepsia are, especially when their malady is of the chronic variety, difficult to deal with. Such persons are intolerant of doctors and of restrictions. Not that they have an aversion to drugs—for this class will drug themselves with a force and a persistency that no rational doctor would countenance—but that they have a shrewd suspicion that it is by their own disordered living that they suffer, and of this they do not like to be reminded. They want no *memento mori* at their feasts. They have entered, as a rule, on a path of self-indulgence, and the thought of having to betake themselves to one of self-denial is repugnant to them. In the majority of cases, especially in the case of individuals who owe their troubles to an over-indulgence in alcohol, the will-power is further so weakened as to be quite unfit to cope with the depressing effects produced, at first, by a more temperate regimen. These cases are often all the more distressing to witness, as the intellectual powers may be good, and the chasm to which the victims are hastening, but too evident to them.

In strong contrast however to the dyspeptic of that class is the sufferer from the atonic form. The latter is, as a rule, very tractable and amenable to reason. Belonging, as he often does, to the thinking and reading classes, he is singularly open to conviction, and, though his ideas of medicine are as a rule limited and crude, he very readily appreciates, and is willing to co-operate in, any treatment the *rationale* of which is explained to him. Many invalids of this class are homœopaths, simply because they think that the system of medicine to which they give their adherence contains a "principle," and they are fond of principles; and this fondness is often in itself the sign of a logical mind, even if the principle selected be not always scientifically defensible. Many again of this class prefer hemœopathy, because, being morbidly sensitive physically and mentally, their minds naturally revolt against the barbarous and absurd methods of thrusting, wholesale, down the throats of invalids potent chemical compounds, whose *complete* action on the economy is not understood, and which the physician would certainly not take himself, nor advise one of his family or circle of friends to swallow. Others dislike the Abernethian style of medical man, who assures them that their malady is the result of fancy, and recommends possibly a skipping-rope, as if a derangement of the fancy, supposing it to be such, were not itself a symptom of gravity, never to be dismissed by any one possessed of even a slight knowledge of the nervous system, in an offhand manner. Besides which, it is not a discussion of terms with the invalids, but a practical question of cure. They know that they suffer and they desire relief, and no medical man will please them but the one who makes that his chief aim. A little care and tact are the first requisite in dealing with such persons; then a few practical points in dietetics and general hygiene may be inculcated; and after that, if necessary, a simple medicine may be prescribed.

But, as a rule, in no point does the sufferer from atonic dysepsia contrast so strongly with the sufferer from the other forms as in external appearance. The former is usually pale, with thin, early-falling hair, which is more ôften fair than dark. The genenal expression is suggestive of weariness and dejectedness. The muscles are often soft, and are evidently out of tone, as indicated by the gait and carriage of the individual. The eyes lack lustre, and are never congested and inflamed. The pulse is usually soft and weak, indicative of feeble heart-power. If a woman, the patient is usually spare, sometimes corpulent, but rarely of that weight which is most consistent with health: if of the male sex, he may be thin and sickly in appearance; but he may also be large in size, but is then flabby, with a decided tendency to perspire, especially in the palms of the hands. The subject of inflammatory dyspepsia, on the other hand, unless he has far advanced in the chronic stage, is often a picture of health; powerful in build and well knit, and much more often florid than pale. The hair is usually dark, thick, and strong. The muscular power is usually quite up to, sometimes over, the average. He is often an agreeable, talkative companion, good natured and good tempered, unless when suffering from one of his so-called "bilious attacks." Sanguine in temperament, he is far from being shy, retiring or cynical, as is often the sufferer from atonic dyspepsia. The eye may be bright, but is more often slightly blood-shot or yellowed by jaundice. The heart and pulse are generally full and strong. Finally the atonic dyspeptic is keenly sensitive of his malady, which evidently embitters his life; the sufferer from the inflammatory form simply ignores his, or refers to it as a slight constitutional infirmity, at which it would be idle to repine.

One more striking difference is observable between the two forms, and this consists in the style of medicine they favour. The robust, inflammatory, dyspeptic knows medicine only in its purgative shapes and forms, and when he refers to physic it may usually be inferred that he limits his remarks to such as those. He is the patron of the various patent aperient pills and syrups. These do him temporary good, ease his so-called biliousness; in reality, relieve his stomach and intestine of quantities of fermenting food, reduce the pressure in his portal vein, and thus relieve the congestion of his liver, both of which conditions would otherwise soon express themselves in a short, sharp attack of acute stomach derangement, possibly accompanied by jaundice. All such medicines are poison to the atonic dyspeptic. If he be compelled to have recourse to aperients, he selects the mildest, and he pins his hopes of cure more on the tonic than on any other variety of medication. He also is a great believer in the various artificial digesters that appear. Pepsin, pancreatin, trypsin, are each in their turn great favourites with him, though, like a feeble man who uses crutches when his only hope of regaining satisfactory power in his legs is to exercise them, so he, by having recourse to artificial digestive agents, only thereby succeeds in still further unfitting his stomach for the performance of its natural and proper work.

It must, of course, be clearly understood that I am speaking only of *typical* examples of the two varieties of dyspeptics. One constantly meets cases that seem to belong as much to one form as to the other, but, as a rule, there is a wide difference, the reason for which will be found in the great divergence in the causation and consequent symptoms of the two forms of disorder.

CAUSES OF ATONIC (GASTRIC) INDIGESTION.

These are all divisible into two great orders :—

1st. Everything that is of a general or local debilitating nature.

(*a*) *Old age.*

(*b*) *Constitutional debility.*

(*c*) *Nervous debility.*—Whatever deranges the nervous system has a markedly weakening effect on digestion. Sexual derangements are, no doubt, very frequently at the bottom of all nervous disorganization, and this fact should steadily be kept in mind, as sometimes a clue is thereby afforded to the successful treatment of a case of dyspepsia, apparently very intractable and obscure.

(*d*) *General debility.*—Such a condition is present in the period of convalescence from acute fevers. Various periods of life are also marked by a tendency to it, especially the period of adolescence. In boys this is, perhaps, more marked than in girls, for in them the growth of the body, and the resulting tax on the general strength, together with the mental and physical work often expected of boys at this time, and the simultaneous awakening of feelings to which they have hitherto been strangers,—all combine to throw the system for a time off its balance and to induce atonic dyspepsia, the many symptoms of which, backed up frequently by the upbraidings of a guilty conscience, furnish the quack with an apt and remunerative theme for a work the perusal of which may lead to some desperate step, even to suicide, on the part of the wretched and bewildered victim.

I suppose a time will come, though it is apparently a long way off, when parents and guardians will awaken a little to the necessity of understanding their children, and recognising the bearing on their nature of certain periods of life. At present, everything is left to chance, and no doubt, as a rule, adolescence is passed over safely ; but in the case of the offspring of neurotic parents that period is apt to be stormy, and the whole future life of the individual may be wrecked, consequent upon its mismanagement. There are no *bad* boys or girls. Whatever evil tendencies are shown at an early age are inherited, not acquired. Boys under thirteen are often troublesome because they are mismanaged and misunderstood. After that age, and sometimes before, they frequently seem to become vicious and licentious. Such boys are not morally bad, but physically ill. They are nearly always the children of neurotic parents, and their nervous system has simply given way under the strain thrown on it at a trying time of life. They are fit subjects for the exercise of kindness, and judicious sympathy combined with tact—the only line of treatment to which their derangement is amenable, and the one which they will keenly appreciate. But I am digressing. The next frequent cause of atonic dyspepsia is—

(*e*) *Want of exercise.*—Persons who possess carriages, and whose idea of exercise is limited to an afternoon drive, suffer for their luxurious habits. Carriage exercise, as it is called, is exercise only as far as the horses are concerned, and as I shall show later on, when we come to the subject of tertiary dyspepsia, persons digest as much and as truly with the muscles of their legs, as they do with their stomachs.

(*f*) *Poverty of blood.*—This is very commonly seen in young unmarried females. It leads to a troublesome form of atonic dyspepsia, marked by a form of biliousness, which has received in some parts of the country, the name of the "green-sickness."

(*g*) *Bad habits.*—Smoking, and especially the habitual use of snuff. This latter cause of dyspepsia is not very generally recognised or known. Long fasting or irregular hours for food, and the drinking of large quantities of hot fluid, such as tea, may be ranked also under this heading. Tight-lacing also finds here a suitable place.

(*h*) *Everything that induces a too large and too constant supply of blood to organs of the body other than the stomach.*—When we remember that there exists in the body but a certain *fixed* amount of blood, it is easy to understand that if any portion habitually takes, and is in the habit of retaining for long, more than its share, the rest of the body will suffer in proportion. The brain-workers are, therefore, as I have already said, the great sufferers from this dyspepsia. They cannot spare the time which is necessary to allow of the disgorging of the blood-vessels of the brain.

Sometimes, in an evil moment, they have recourse to the aid of alcohol, which certainly assists the digestive process considerably at the time, but which is both a mistaken line of treatment, inasmuch as it merely cloaks, and does not tend to remedy, the disease, and furthermore a possible source of danger, since it may become an established habit at other than meal times. Professional athletes who keep their muscles in a state of chronic congestion, and the sufferers from any form of congestive or inflammatory complaints, are equally with brain-workers, the subjects of this form of dyspepsia.

General Symptoms.—These, like their causes, are more or less directly opposed to those present in the inflammatory forms of dyspepsia, and vary infinitely more both in degree and kind, than do those of that latter class. Thus it is scarcely possible for anyone with any pretence whatever to medical knowledge, to mistake the seat of the mischief in acute or chronic inflammatory dyspepsia, but in the atonic form, so manifold and so little referable to the stomach are the symptoms, that the real seat of derangement can often be only diagnosed, and then with difficulty, by a physician who has had special opportunities of studying the various forms of indigestion.

It will be remembered that in describing inflammatory dyspepsia, I spoke almost solely of symptoms relating to the stomach, pain, discomfort, nausea, thirst, &c., and made scarcely any reference to pains in other portions of the body. Such remote pains do occur undoubtedly in that complaint, but they occupy quite a secondary place. The patient comes to be treated for his stomach or liver, and to these he wishes his medical man to devote his attention, feeling certain that, when those organs are again in good condition, his back-ache, and his other feelings of uneasiness will vanish.

Now the class of symptoms that the atonic dyspeptic throws into prominence are nearly always the secondary. The doctor is told of melancholy, of vertigo, of palpitation, of perspirations, of headaches, of sleeplessness, of dimness of vision, of ringing in the ears, of spots before the eyes, of want of energy, and of special weaknesses, but often *not one word about the stomach.* Of course, sometimes the patient is convinced that the stomach is the real *fons et origo mali;* but much oftener he considers the brain, the heart, the lungs, or the kidneys to be the real seat of disease.

Let us then, reversing the natural order, take the secondary or remote symptoms first.

SYMPTOMS DUE TO CONDITION OF STOMACH, BUT NOT OFTEN REFERRED TO IT.

Head.—Giddiness, especially on suddenly rising. This is due to want of tone in the walls of the heart and great blood-vessels, and is seen in all states where the general health is out of order.

Dimness of vision.—This again is connected with the heart and circulatory system ; at least, that form of dimness of vision which becomes worse on great exertion or on going upstairs. But both this symptom and the preceding one generally disappear when the general tone of the stomach is restored.

Noises in the ears.—These as seen in dyspepsia may have their direct origin in the circulatory or in the nervous system ; most often in the latter.

Altered sensations of taste and smell.—These are concerned solely with the nervous system, but yet, like the other symptoms, depend indirectly upon the weakened state of the stomach.

General expression. — The face bears an anxious and worried look. The white of the eye is rarely clear. The tongue is often but little coated, not unfrequently large, pale and flabby, with indented marks of the teeth at the edges. The teeth and mouth are usually clean and well kept, and the breath is but rarely offensive. The throat is pale and bloodless, as are also frequently the lips.

The heart and the general circulation are weak, as evidenced by a feeling of faintness if the patient stands for long, or if he suddenly rises after stooping. Palpitation is a common symptom, and one that greatly distresses the patient. To such a pass, indeed, is the sufferer sometimes brought, that the lips may become blue, the face livid and anxious, and covered with cold perspiration, and the breath gasping—symptoms that pass off promptly on the administration of a little sal volatile or brandy, and which are, merely due to a temporary collection of flatus in the stomach, which by its mechanical effects, hampers still further the labours of a weakened heart.

Chest-symptoms are often complained of; and a short dry cough, suggestive of consumption, may be present. Sometimes patches of congestion are discoverable in the lungs; but both they and the cough are the result, direct or indirect, of the gastric disorder; and the fears of the patient, and often of his medical attendant, who are wont to attribute them to phthisis, prove entirely unfounded. Sometimes the expectoration of blood is superadded. A near relation of my own has for the past fifteen years suffered from atonic dyspepsia, complicated with this pseudo-phthisis, and has received, over and over again, the blackest of prognoses from the best of men. He has spent a small fortune in residence at various resorts for consumptives, but is, despite all fears, at present perfectly well, nor can the strictest scrutiny detect the smallest sign of present or past mischief in his lungs. Cases such as these I am constantly coming across. The cough of the atonic dyspeptic is, unlike that of the inflammatory dyspeptic unaccompanied by expectoration.

The skin has in most cases a tendency to be damp, and that of the hands and feet to be cold as well as moist.

Constipation is an almost invariable symptom, and its presence may lead to hæmorrhoids (piles).

Flatulence is often, especially in the female sex, a distressing symptom.

The mental faculties always suffer. Drowsiness is a common symptom; depression of spirits, and an irritability which leads to a cynical and fault-finding spirit, are, as I have already observed, very frequently present. In some few cases I have seen epileptiform fits. Great restlessness is also a well-marked symptom.

What wonder that the ancients attached to these combined symptoms the name of melancholia, or black bile, and considered that the patient's condition was due to the circulation of disordered bile through his body. Later on, when we come to the liver, we shall find that atonic dyspepsia is indeed frequently associated with a similar condition in the liver, which actually permits of bile and improperly digested articles of food finding their way into the blood, and that to this may many of those symptoms, ascribed sometimes to the patient's fancy alone, be directly traceable.

SYMPTOMS REFERRED TO THE STOMACH.

Sense of weight and discomfort after food, sometimes combined with flushing of the face and pain in the back. The development of gas (so-called "wind") in the stomach, an hour or two after food has been eaten. An inability to take fluids, which have the effect of increasing the development of gas more than do solids. The passing of food rapidly through the stomach, with a resulting tendency to go to stool soon after each meal. Absence of feverish symptoms—a negative sign of value in separating the two forms of dyspepsia.

Now, none of the above symptoms are to be relied on as constant; in fact, many cases which do not present a single one of them, and which yet are clear cases of atonic dyspepsia, are to be met with. I particularly well remember one case in point, in which, combined with secondary symptoms of a very distressing kind, there was a complete absence of primary ones, and the patient had received the most varied medical opinions as to the nature of his complaint. The use of the stomach-tube every third day, at varying periods, and after meals of selected food, whose natural rate of digestibility was well known, established, however, the fact that, whatever else might be amiss with him, the digestive power of the stomach was gravely at fault; and the case ended in very rapid and complete recovery, after a short voyage to the Mediterranean.*

If I were asked to name a great man who suffered from typical atonic dyspepsia, I should select Carlyle, and another, not a drunkard and not a gourmand, who yet suffered from frequent attacks of acute inflammatory dyspepsia—the irritation from which led eventually to the development of cancer—I should name Napoleon the Great.

DURATION OF ATTACK AND PROGNOSIS.

Usually the attack is a long one, and complete recovery is sometimes impossible. In fact, atonic dyspepsia is, unlike the inflammatory form, often *natural* to the patient. Very frequently it is his hereditary lot, and but an expression of a generally low state of vitality. Again, it often comes on quite naturally as a result of old age, and in that premature form of physical degeneration, which we sometimes witness in people soon after forty-five years of age. In such cases it is, of course, useless to imagine that the digestive power can ever be brought up to that of a healthy vigorous man, but—and this fact is always to be remembered—the food can always be brought *down* to the limited power of the organ, and thus all, or nearly all, the distressing symptoms which attend on the swallowing of food of a kind and amount in *excess* of the digestive powers is obviated; this can be effected, as a rule, with ease, and always without further imperilling the strength of the patient.

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* The use of the soft stomach-tube is a most valuable means of diagnosis, and one much neglected. The patient passes it himself by successive swallowing efforts, without difficulty or discomfort; and the medical man obtains very simply and easily a specimen of the contents of the stomach, from the condition of which valuable information is procurable.

But again there are many cases of atony of the stomach in which the condition is merely due to some temporary cause, usually something affecting the nervous system; examples of this are seen in boys and girls at the period of adolescence, and in women at the so-called change of life. During recovery from all severe illness, a period of atonic dyspepsia has to be faced. These latter cases, with tact and care, regain, as a rule, robust digestive power, but if they be mismanaged, a chronic and perfectly incurable form of the mischief may be induced. The outlook in all cases of long standing atonic dyspepsia depends more upon the general condition of the nervous system than upon anything else.

TREATMENT.

As in the case of inflammatory dyspepsia, I shall not endeavour to divide the subject of treatment into the two divisions of hygienic and scientific, but shall consider both of these together. The treatment of atonic dyspepsia is, on the whole, much more hopeful than that of chronic inflammatory dyspepsia, for the latter is always a form of degeneration, and therefore in advanced cases quite incurable; the atonic form may also be the result of a degeneration, but is not necessarily so, and therefore in many cases a complete rehabilitation of health may reasonably be looked for. But there is no derangement that the medical man is called on to treat which demands the exercise on his part of greater skill, tact, and patience. Everything often depends on the dietary; little or nothing on drugs. It is so in all forms of indigestion, but in that form, the treatment of which we are now considering, it is specially necessary, owing to the great weakness and irritability of the stomach, to exercise extreme caution in the administration of medicines. If they fail to do good, even if they do no tangible harm, we lose the confidence of the patient, without which we shall find it difficult to enforce even the most rational dietetic rules. Not that I utterly condemn the employment of drugs in this complaint, for most of those used by the physician are really of the nature of condensed foods, and intended to supply a deficiency of some salt, a natural constituent of the healthy body; but in a complaint where the simplest foods often disagree, we shall not be surprised to find that concentrated ones (such as are some so-called drugs) are often badly borne, and therefore require to be used with the utmost discrimination.

In treatment, I recommend the three following measures. 1. Remove or moderate the evil influence which has caused the complaint. 2. Apportion the amount and kind of food to the strength of the digestive organ. 3. Seek to invigorate the stomach and the system in general.

1st. *Removal of cause.*—As everything that debilitates the body generally, weakens also the stomach, it is clear that wholesome surroundings and a rational mode of life must be amongst the main objects to be secured. Congenial employment, suited to the strength, and giving employment to the mind, exercise in bracing air, regular bathing, and the use of well-ventilated sitting and bed rooms, are often alone potent enough to restore an invalid to health. Morbid and exciting literature, the companionship of weak, emotional, and sentimental people, as well as all bad habits, such as excessive smoking, snuffing and immoderate tea-drinking, all of which tend to debilitate the nervous system, are to be avoided. In short, everything that common sense recommends as likely to induce the happy state "of a healthy mind in a healthy body" is to be sought for, and everything with a contrary tendency, to be shunned.

2. *Apportion the food to the digestive powers.*—This is an indication for which it is difficult to lay down hard-and-fast rules, for while one atonic dyspeptic will live, and grow fat, on Benger's Farinaceous Food, or on Du Barry's Revalenta, or other of the patent foods advertised, to the exclusion of almost everything else, and will declare that foods such as those are the only ones that he can digest with comfort, another patient, apparently equally dyspeptic, will be able to take and digest game, poultry, and various red meats and fishes, and will assert that such agree with him much better than any form of slop food. Of course, if we could be certain that in all cases the stomach *alone* was affected with weakness, and that the other digestive organs were in perfect working order, our task would always be light and usually crowned with success; but we know that the human body is not a mere admixture of separate organs, each of which works only for itself, but is a machine of a most perfect and elaborate workmanship, and so sensitive that the derangement of a single portion of the mechanism is followed, of necessity, by an all-round lowering of function and derangement of the general equilibrium. However clear, then, it may seem to be that the mischief originates in, and is confined to, the stomach alone, we must make wise allowance for other contemporary debilities, the sequence or possibly the cause of it. We should therefore in our diet-tables, even when sure that we have before us a case of gastric debility, while decreasing as much as we safely can those nitrogenous articles of food with which we know the stomach concerns itself, keep a watchful eye also on the digestion of the starches and fats.

Even after eliminating from our calculations all the cases of idiosyncrasy in regard to nutriment, and for which no rules can be laid down, we shall, on account of the varying grades of severity in this disorder, have to divide our regulations into three divisions to render them of any practical value.

First of all we will consider the question of nourishment in cases of extreme but often temporary weakness of the gastric digestion. These are met with during the course of the severer forms of fever—scarlet fever, typhoid fever, cholera, small pox, etc., and indeed in all feverish states, except those where the fever is the direct result of a congestion or inflammation of the substance of the stomach itself. This condition is also that of the stomach in very advanced old age, and in cases of severe and exhausting disease, not necessarily of a febrile nature. It was formerly supposed, judging from the state of the tongue only, that in fever the stomach was in an inflamed, rather than in a semi-paralyzed, state. The same mistake, judging from the delirious excitement often present, was made as to the condition of the brain in such attacks. These views have long since been shown to be erroneous, both brain and stomach being, as regards their supply of blood, in a starved rather than an over-fed condition.

In the dietetic treatment of these cases dependent on semi-starvation, food must be selected which can most easily be absorbed, or which, if not digested, cannot furnish much waste likely to undergo fermentation in the bowels. To meet the very diminished digestive powers, nourishment must be given in small quantities at a time; but, on the other hand, with a view to the maintenance of strength, must be given at frequent intervals. General starvation of the whole body is the great evil to be feared and guarded against.

Bearing in mind that the nervous system controls digestion equally with all other functions of the economy, we must select from our armoury foods which possess some stimulating properties, so that the nervous system may be saved from fatal lethargy; such properties exist very largely in meat; but as it would be obviously absurd to expect the mouth and stomach in a febrile state to perform their usual duty of grinding such food and separating and dissolving its fibres, we make use of fluids which contain much of the nourishing and stimulating powers of the meat, but in a palatable form and in a small compass. Such fluids which are rich in albumen, will, we may justly hope, help to repair some of the waste of the nitrogenous material of the tissues which takes place so rapidly in fevers, though recently it has been asserted and, I must admit, with great reason, that in febrile states all power of repair is in abeyance. At the same time we should keep two points steadily in view, namely, that for the first few days of the illness it is the fat, and not the nitrogenous tissues of the body, that are burning so as to produce the fever heat, and that therefore meat essences are to be used but sparingly during that period; and, that the process of preparation which albumens undergo in the liver is a long and a difficult one, and even when the patient is in the most dire straits from rapid wasting, we may, in our anxiety, unless we be cautious, not feed up the patient but break down his liver and lead to irreparable disaster. Our regimen should shape itself much as follows:—milk and all milky products, skim milk, whey, buttermilk, koumiss, Frankland's artificial milk, thin milk gruels, milk soups, and the various farinacea, without eggs. Beverages may be made by boiling various fruit jellies in water, and these may be made nourishing by the addition of *grape sugar*, which may be obtained at some of the larger chemists. Gum-water and oatmeal-water, flavoured to suit the taste, may also be used; indeed when given warm, with the addition of a few cloves and a very small amount of good claret, they are often most palatable and useful beverages. Weak tea and milk or coffee and milk, half and half, may as a rule be given, for both coffee and tea have a very decidedly beneficial effect on the nervous system in fevers, and are credited, on good authority, with the power of preventing rapid waste of the body tissues.

Then there are the many foods which are specially made for infants and invalids. Benger's farinaceous foods, Du Barry's food, Russian food, Egyptian food, Mellin's, Œettle's, Nestle's, Savory and Moore's and Ridge's foods, *et hoc genus omne.* These may be used plain, but are generally better given to adults as a thickening in meat essences. They may all be commended as in every way suited to this stage of the complaint. Very often fruits may be allowed—grapes, ripe oranges, ripe pears, green figs, strawberries, raspberries, peaches, nectarines, etc. These are themselves rich in grape sugar, and are most nutritious. They are sometimes banished from the sick-room owing to old-fashioned prejudice. Cream is the only form of fat which an invalid will as a rule look at, and this may conveniently be given with stewed fruit.

Then come the meat essences. These may be plain or artificially digested; of both there is a large and excellent supply in the market; or home made chicken broth, veal tea, or mutton broth may be administered. Beef-tea is, as a rule, unsuited for this stage. Gelatine, in the form of jellies, may be given; for though itself not nourishing, it possesses the property, like fats and starches, of saving the albumens from rapid oxidation. In the body, gelatine is rapidly formed into urea, and this action is again sometimes made use of in fevers, for the excretion of urea excites the kidneys (half paralysed by the fever-poison) to better action. Gelatine must not be regarded, however, as a substitute for the albumen in meat and fish, as it possesses no power of repairing the tissues.

The second grade of atonic dyspepsia is best seen in the early days of convalescence from severe illness. Appetite is returning, and with it the taste for food. This is a grade the management of which requires the greatest care. The digestive powers are exceedingly feeble and soon overtaxed. The food at each meal should be increased in amount, rather than in kind, in comparison with that in the severer stage. We may, however, gradually introduce white fish, steamed or boiled, farinaceous puddings, cocoa and chocolate, and perhaps a little game or poultry.

The third and commonest grade comprises that large class of cases in which the patient is completely free from fever, and is able to go about the ordinary duties of life, but finds that extreme caution has to be exercised in the selection of foods, or the penalty of discomfort in the abdominal regions, or some one or more of the various disagreeables which I have enumerated, has to be paid. This is the normal condition of life in many individuals of an inherited weakly constitution. The first thing that dyspeptics of this class have to learn is, that their fellow-creatures eat a great deal more food than they actually require. Civilisation has diverted eating and drinking, and some of the other functions of the body, from their original intention, that of merely maintaining life, to a main source of sensual gratification, for which people pay dearly by early exhaustion of those very powers of enjoyment. The atonic dyspeptic need not therefore fear the result of a mere diminution in the amount of his daily food. I give the following as general recommendations.

The number of meals should be three a day. If an extra meal be taken in the evening—and some persons cannot sleep unless they partake of something before retiring—it should consist of a few biscuits and a glass of milk or a cup of cocoa, a milk pudding, with fruit, or a new-laid egg on toast. In some cases of old age and feeble power, even a fifth meal may be advisable, namely, at five or six o'clock in the morning, or, at any rate, before rising. This may consist of a few biscuits and a glass of some natural wine, or of a cup of coffee. Without this early refresher some invalids experience great giddiness and depression of spirits from lack of support, and sometimes, in cases where the heart has been abnormally weak, fatal syncope has occurred.

Breakfast.—This is to be taken soon after rising, and should not be preceded by a walk or any exertion; for a constitutional on an empty stomach produces only nausea and disinclination for food in weak people. This should be a good substantial meal, for it is always the one which a dyspeptic of the atonic type can best digest, probably because his stomach is really empty when he sits down to it. This, by-the-bye, is usually the case at no other meal, as I have verified by experiments with the stomach-tube, having extracted by its means from the stomach, seven or eight hours after their consumption, albumens whose normal rate of digestion varies from one hour and a half to two hours. This meal may usually consist of a selection from some of the following foods: eggs, hominy, wheatmeal, or oatmeal porridge, bread and milk, cereals of all kinds, toast whole-meal bread and butter, crisply fried bacon, white fish Fruit is an excellent adjunct to breakfast, and should be taken with that meal by all who can afford it.

Beverages.—Tea, with a pinch of bicarbonate of soda added, coffee, cocoa or cocoatina, chocolate. In many cases a light wine, with plain or aërated water, is however to be preferred.

Lunch, taken about midday, may consist of soup and a farinaceous pudding and a little fruit. A few oysters or a small piece of fish may replace the soup. A little light wine, plain water, a glass of milk and soda-water, or a cup of coffee form the most suitable beverages.

Dinner (the *crux* of the dyspeptic) should not be earlier than 6 or 7 p.m.

Soup should be avoided, or taken in small quantity. Maigre soups however, are unobjectionable.

Fish.—Boiled or steamed white fish, such as sole, plaice, whiting, etc. If fried fish be eaten, the fish should be cooked (really, rapidly boiled) in butter or oil, not in fat.

Meat.—Game and poultry or short-fibred meats, such as mutton or venison. The flesh of young animals is, as a rule, indigestible. All salted, pickled, and twice-cooked meats are to be avoided, as well as all meat pies and puddings.

Vegetables. — Plain boiled rice, macaroni, vermicelli, or bread, are often to be preferred to the ordinary vegetables. Roasted potatoes or potatoes that have been first thoroughly boiled and then pressed through a wire sieve, *pommes de terre au riz*, so as to look like rice-grains, are, I consider, the best forms in which the favourite tuber can be eaten. Mashed with butter, it is decidedly objectionable as a viand for the dyspeptic. Broccoli, spinach, young carrots, beetroot, young turnips, and very young and fresh green peas are usually admissible. The cruciferæ, to which order belong the cabbages, are to be avoided, the sulphur which enters into their composition being often converted, in dyspeptic states, into sulphuretted hydrogen and other highly offensive and troublesome gases. The action of such gases, when absorbed into the blood, is, by their reducing effect on the urates there, to produce oxalate-of-lime crystals in the urine, and a temporary and troublesome condition known as oxyluria.

Puddings.—In the vast majority of cases, these should be avoided, and their place taken by ripe fruit or stewed fruits and cream. If, however, the dyspeptic will brave the risk, fruit puddings, in which bread-crumb takes the place of the ordinary covering, or suet puddings made with equal parts of flour, bread-crumb and suet, or plain farinaceous puddings, made without eggs, are the best.

Amongst *fruits*, grapes, strawberries, raspberries, and oranges are to be preferred. Gooseberries, currants, raisins, and stone fruit are not so admissible. Pears, unless very ripe, and apples, are not so good, and are best when stewed. The amount of sugar necessary to the preparation of stewed fruit makes this dish unsuitable for invalids. Dyspeptics will do well, then, to take their cue from the preserve-manufacturers, who, in the days when sugar was dear, used to add bicarbonate of sodium to the crushed fruit till nearly all its acidity was neutralized, and then to make a small addition in the way of sugar. The bicarbonate of sodium undergoes chemical change, and is not objectionable in the food, as it would be if given simply. It furthermore *corrects* the acids of the fruit of which sugar only *covers* the taste. Crystallized fruits, pineapples, and nuts are to be avoided.

Beverages at dinner.—On the whole, it is generally best, in cases of atonic dyspepsia, to advise but a small quantity of any beverage at dinner, the fluid additions to food that may be considered necessary being consumed one or two hours after the meal. For patients who will not drink plain or simple aërated waters, claret, hock, carlowitz, marsala, or a *natural dry* sherry, with plenty of plain or alkaline water, or a little whisky and water, are best.

The patient should eat very sparingly of each course, avoiding every article that experience has shown to be, in his special case, objectionable.

3. Our third and last indication for treatment consists in

Strengthening the powers of the Stomach and of the System Generally:—I have already expressed a belief, which increasing experience tends daily to confirm, that in nine-tenths of the cases of weak digestion with which the physician comes in contact, the stomach is not much at fault, but merely sympathises, as it were, with the general bodily weakness. An analogy to this state of matters is found in the case of the heart. In nearly every case of so-called "weak heart," the state of that organ is really in strict keeping with the strength of the body at large, and the condition is to be treated only on the general lines of increasing the whole bodily strength. Nay, I am prepared to go further, and to assert that both a weak stomach and a weak heart, when found in connection with a weak body, are an advantage, their powers of supply being in proper proportion to the needs of the infirm body, and that any attempt at strengthening them, whilst leaving the body in its debilitated state, would, were it successful, which is extremely unlikely, lead only to that loss of that equilibrium which exists even in states of general prostration, and the want of which would inevitably tend to an increase of mischief. In atonic dyspepsia we are, in this connection, brought once more face to face with another point of variance between it and the inflammatory form, for in the latter the *state of the stomach is quite out of keeping* with that of the rest of the body, and bears no sort of relation to it. In considering the medicinal treatment of atonic dyspepsia the reader will, therefore, not be astonished if I lay greater stress on the means to improve the general health rather than on those which possess but a *local power.*

First amongst drugs that in atonic dyspepsia exercise a potent effect on the whole nervous system stands *nux vomica.* This medicine possesses the power of stimulating the nerves that come from the spinal cord, and of acting, but less energetically, on those which comprise the sympathetic system of nerves, which have but a comparatively slight connection with the spine. The effect of this stimulation is to improve the whole tone of the muscular system, and with it that of the muscular coats of the bowel and intestines, to increase blood-pressure, and to promote in both ways the digestion of foods and the removal of waste products. Its derivative, strychnia, acts in a somewhat similar manner.

What an excellent drug! my readers will exclaim; but they must remember that even in cases where the effects, such as I describe, are actually *felt*, for though they always occur, they are not always perceived, a reaction sets in subsequently. All tonics—and nux vomica is of course a tonic—are but stimulants, not so rapid and evanescent as alcohol, but still simply stimulants, force-liberators, not force-producers. The administration of the drug can be kept up, and its dose can, in many cases, be slowly increased so as to maintain the effect; but reaction eventually *must* set in, and is infallibly proportioned to the amount of the drug consumed. But for this reactive effect of all tonics and all stimulants, nineteen people out of every twenty would be, and should be, constantly taking tonics. The reader does not find these points stated in books on drugs. If he take up any book on pharmacology, he will be, as the medical student often is, profoundly affected by the number of, and the beneficent powers ascribed to, the many drugs. For every disease, and for every disagreeable symptom under the sun, are from twenty to forty direct antidotes. Sooner or later, in accordance with his powers of observation, the young practitioner comes to find that amongst the most intelligent of his patients and the best qualified of his colleagues there is a profound and general scepticism as to the use of any drugs, and he often rushes to the conclusion that the *whole* treatment of disease by means of drugs is a culpable and a contemptible farce. The truth really lies between the two extremes. Drugs possess, as a rule, the actions ascribed to them; but their beneficial effects *only* are enumerated, not their deleterious or their secondary ones. The natural tendency in all living bodies to regain their equilibrium is not satisfactorily explained to the student, nor the great part played by this in disease, and the full interpretation of the symptons induced by such efforts is never inculcated. Finally, the student is left to find out for himself the narrow limits and restrictions within which drugs, properly so called, are useful.

But to proceed with a consideration of the virtues of nux vomica. Its action is often marked in causing a regular daily evacuation of the bowel, and in preventing an accumulation of gas in them, both of which effects are due to its power of temporarily improving the muscular system in the intestinal and abdominal walls.

The dose and mode of administration are as follows:—

Of the tincture of nux vomica 5 to 10 drops in a wineglass of water, thrice daily (for adults).

For adults who suffer much from atonic dyspepsia, with constipation, the following formula is useful:—

Sulphate of iron, $\frac{1}{2}$ gr.; extract of nux vomica, $\frac{1}{2}$ gr.; extract of aloes, 3 grs. One pill at dinner-time each day for six days; then every second day for twelve days; then twice a week for a month.

For the aged who complain much of flatulence and constipation the following is often beneficial:—

Tincture of nux vomica, 7 drops; Glauber's salt, 2 drs.; tincture of cinnamon, 10 drops; tincture of cayenne, 5 drops; infusion of gentian, $\frac{1}{2}$ oz. The dose to be taken in half a tumbler of water, twice a day, before food.

Or a dinner-pill, such as the following:—strychnia, $\frac{1}{30}$ gr.; powdered ipecacuan root, 1 gr.; powdered capsicum, $\frac{1}{2}$ gr.;

compound aloes pill, 3 grs. The pill to be taken each day at dinner, for ten consecutive days.

The second drug that is useful in atonic dyspepsia is *Peruvian bark.* The preparations of it most in use are, the acid infusion of cinchona bark, the dose of which is one to three tablespoonfuls, in plenty of water, twice or thrice daily, the tincture of the red cinchona bark, and the compound tincture of red cinchona bark, the dose of each being one to two teaspoonsful in water twice or thrice daily.

For ladies and children, I have often found the following mixture agreeable and effective :—

Oil of orange, 6 drops ; rectified spirit, 1 oz.; dissolve and add tincture of red cinchona bark, ½ oz. ; tincture of cinnamon, ½ dr. ; glycerine and syrup, 1½ oz. each. Mix, and administer according to age from one-half to two teaspoonfuls thrice daily, in plenty of water.

Or the following:—Steep, for seven days, three-fourths of an ounce of powdered red cinchona bark in a pint of malaga wine, shaking occasionally ; then strain and administer it in doses of one to four teaspoonfuls two or three times a day. This preparation, like the preceding, is readily taken by children and is a very close imitation of the vin de quinquina of the official French Codex.

The preparations of cinchona, unlike those of nux vomica, should not be administered unless the tongue be clean, and there be a complete absence of fever. Quinine bears the same relation to cinchona or peruvian bark that strychnia does to nux vomica ; and both are much more limited in their uses, and much more apt to disagree, than the bark and the nux vomica from which they are derived. Quinine is distinctly unsuitable, as a general rule, for persons over forty years of age and for children under ten years. The adult dose is from half a grain to two grains, two or three times a day, in pill, or in sherry or orange wine. In cases of severe atonic dyspepsia, with carstipation, the following formula, which contains quinine, will be found very serviceable :—

Sulphate of quinine, 25 grs. ; dilute sulphuric acid, just sufficient to dissolve the quinine ; compound tincture of gentian, 2 oz.;

oil of cloves, 6 drops; aloes wine, 2 oz. The mixture to be well shaken, and administered in doses of from 1 to 2 teaspoonfuls in a wineglassful of water twice daily.

In the case of ladies, it is a good plan sometimes to advise that one grain of quinine be dissolved in a teaspoonful of sal volatile, which shall then be mixed with a wineglassful of water. Such a dose may be taken twice a day.

Some persons complain that quinine gives them headache. I enclose a formula that will obviate the occurrence of such a drawback:—

Hydrobromate of quinine, 30 grs.; tincture of orange peel, 2 drs. syrup of orange, 2 oz.; water up to 6 oz. One tablespoonful in water thrice daily.

For children to whom it is desirous to administer quinine the following formula is useful:—

Citrate of quinine and iron, 24 grs.; tincture of orange peel 2 drs.; syrup of orange, 2 oz.; simple syrup, 2 oz.; water, 1 oz. One teaspoonful for children up to four years, and double that dose from four to eight years, three times daily.

The above preparation is palatable; but as quinine does not generally suit children, it will rarely be required.

The next drug is *iron*. This again is of even more restricted use than quinine, which it resembles in not agreeing with elderly persons. In fact the limit for the beneficial administration of it may be fixed as low as forty years of age. Nevertheless, in young people, especially in young unmarried females who suffer from a form of derangement which doctors variously call "chlorosis," "anæmia," spanæmia," etc., but which, when of a very troublesome kind, with prominent stomach symptoms, is popularly known as the "green sickness," there is no drug which has such a marked and beneficial effect as iron, especially in the following form:—

Steel drops, 3 drs.; chloride of ammonium, 3 drs.; spirits of chloroform, 3 drs.; simple syrup, 4 oz.; water, up to 8 oz. One tablespoonful in plenty of water, thrice daily, after food.

Or the following:—Steel drops, 2 drs.; citrate of potassium, 1 dr.; syrup of lemons, 1½ oz.; water, ½ oz. Mix. One teaspoonful in a wineglassful of cold water thrice daily.

This latter preparation is not nearly so efficacious, but is more palatable than the former one.

Finally, in the case of robust adults it is sometimes necessary to combine the stimulating properties of iron with a purgative: thus—

Sulphate of iron, 30 grs.; sulphate of magnesium, 1 to 2 oz.; dilute sulphuric acid, $1\frac{1}{2}$ dr.; glycerine, 2 oz.; spirits of peppermint, $1\frac{1}{2}$ dr.; water, up to 8 oz. One-eighth part in water, twice daily, after food.

Iron, it must always be remembered, is to be regarded, in the case of young people, as a food. It forms one of the principal constituents of the blood-cells, and is a natural ingredient in more than one article of food. There are many other drugs used in atonic dyspepsia, the foremost perhaps being arsenic. Itself in large doses a potent irritant of the stomach and intestines, it often effects marked good when administered in reasonable doses. The mode of prescription mostly used in this country is that of Fowler's solution, the dose of which is from one to four drops, in water, thrice daily, *after food*. As, however, it tends to accumulate in the system, in fact becomes deposited in the liver, it is best to take it only under medical supervision. Another drug which for a long time held a high place in popular esteem was phosphorus. It is a nerve-tonic of great power; in fact, a most potent stimulant. The dose usually administered, from one-fiftieth to one-sixteenth of a grain, is, in my opinion, far too large, and likely to lead to dangerous after-consequences, though the immediate results are sometimes apparently beneficial. Phosphorus is an essential element in some of the structures of the body, notably in the nervous system. It seems in some ways to be able to replace nitrogen. Its natural use in the economy is unknown, but it evidently plays a very prominent part in the phenomena of animal life.

We must now consider the question of *climate* in its relations to atonic forms of dyspepsia. There can be no doubt that climate is an important factor in the production of those states of the body which induce weakness of the digestive organs, and that it can therefore be often rendered available as a means of cure. A damp, relaxing air, such as is present in the neighbourhood of large fresh-water lakes and rivers, forms a specially unsuitable medium for the sufferer to live in. The valley of the Thames, in which London proper is built, is therefore an unfavourable spot. If the patient must reside in London, or be much in London, let him take a house on the hills that bound the valley. St. John's Wood, Highgate, Hampstead, Denmark Hill, and Champion Hill, the high ground about Sydenham, etc., may be named as favourable sites, though the first three are to be preferred, the north and north-west of London enjoying a drier and more bracing air than that of the south and south-east. For very elderly persons, and in all cases where, the circulation being feeble, cold is acutely felt, the more central parts of London, the west and west-central districts, form suitable winter resorts.

In search of a place to spend a summer holiday, the atonic dyspeptic, if young, will do well to select the east rather than the south and west coasts of England; and if his means allow of it, there is nothing that will do him greater good than a trip to the Highlands.

The *soil* plays a *rôle* second, perhaps, only to climate, in the causation of atonic states. A clay soil, especially if the surface drainage be inefficient, is decidedly hurtful; and even in cases where the surface drainage is unexceptionable, sandy or gravelly soil, especially if on slightly elevated ground, is much to be preferred.

Upon the structure of the house he inhabits will often depend the question as to whether the patient knows that he lives on a damp clay soil or not. If the foundations be good and the basement floors be of stone, or, better still, of concrete, and damp courses, etc., are in good order, the inhabitant will be unaware often of the nature of the soil; but if the house be the work of the modern jerry-builder, the exterior will usually be found to have so engrossed the builder's attention, that such essentials as I have named will have been regarded by him in the nature of lights placed under a bushel, and the damp from the wet clay underneath rising into the warmer air of the house will seriously lower the health of the dwellers, and produce, in those susceptible to them, all the symptoms of general atony. A southern aspect is to be always preferred for a residence.

Bathing.—In the case of the young, a cold or tepid bath or tepid sponging of the whole surface of the body, followed, if the reaction be bad, by a free use of the flesh-brush, should be a regular morning performance. In addition to the above, the patient should take, at least once a week, a hot bath before retiring to rest.

Exercise.—This is of very great importance. After their morning bath, and whilst yet the limbs are unfettered by much clothing, many persons of both sexes make it a practice to use the dumb-bells or Indian clubs for a quarter of an hour; but, in the case of the feeble such exercise, especially the use of the clubs, induces too much fatigue, and tends to deprive them of appetite for the morning meal. As much outdoor exercise as can be obtained without fatigue should be secured. Gymnastic exercise, lawn tennis, football, cricket, rowing, and swimming are to be recommended. For those who can afford it, horse exercise is often very useful, as it has a good effect on all the abdominal organs. Tricycle exercise serves as a partial substitute for it.

Rest.—Seven to nine hours in bed is amply sufficient Longer sleep tends rather to obscure than to clear the intellect, and to produce debility. A hard bed is much better in many ways than a soft one.

We will now finally, before dismissing the important subject of atonic dyspepsia, devote a few paragraphs to a consideration of the purely *local* treatment of this disorder.

First, *artificial digestive agents.*—At first sight nothing could be more reasonable than, if possible, to pre-digest the food given to a weak stomach. But, on reflection, the practice is seen to be a bad one. We want our stomachs to resume their work, and not to retire from active service and leave us to rely on the chemist; artificial digestive agents are therefore to be regarded with a certain amount of distrust. Again, it must be remembered that in many cases, as in acute fevers, in which we would gladly avail ourselves of any temporary help, the *whole* digestive apparatus is in a disordered condition. The salivary glands, the liver, the pancreas, the intestines, and the tissue cells are all paralyzed. There is, both in health and in disease, an interdependence, one on the other, of all these organs. Still the effects of artificial digestion deserve a trial in all very severe cases, where we are convinced that the absorptive powers of the stomach and intestinal glands are gravely deranged.

The following is a list of the best-known preparations which can assist the digestive function in the stomach:—the acid glycerine of pepsin (Bullock's), liquor pepticus (Benger), pancreatine powder, saccharated pepsin (an American preparation), poudre nutritive, liquor pancreaticus (Benger), pepsin tablets. pepsin wine.

The dosage of the above is indicated on the bottles in which they are sold; and the method of using those of Benger, which are very efficient, is supplied in printed form with each bottle. I shall therefore refer the reader to them for the modes of making peptonized beef, peptonized gruel, etc.

I have added to the above list the pancreatic digestive agencies, as the functions of the pancreas are in many ways identical with those of the stomach and salivary glands; and as those agencies are quite as efficacious, and more agreeable to the palate than those of pepsin, even in cases of stomach-derangement pure and simple.

Acids and alkalies.—There exists a therapeutic law, which there is good reason to suppose is founded on fact, that an acid applied to the orifices of glands which prepare an acid secretion will check that secretion, and that an alkali will stimulate it. For this reason, if we have grounds for supposing that there is present in the stomach an over-secretion of hydrochloric acid, we should, and do, administer hydrochloric acid. If the acid present in the stomach be, however, one, such as butyric acid, which has resulted from the decomposition of food, the effect of such a medicine will be, of course, *nil.* Now, in atonic dyspepsia we have to do with a *deficiency* of digestive fluid, and therefore, on the strength of the above law, we administer alkalies, especially the bicarbonates of soda and of potash; and we administer them before food, that is when the stomach is empty, and the alkali will come most easily in contact with the openings of the ducts which prepare the acid gastric juice. This method often gives very satisfactory results. The following is a simple but efficient formula:—

Bicarbonate of potassium, 1½ dr.; infusion of quassia and cassia water, of each 4 oz. One-eighth part in plenty of water, three times a day before food.

Stomachic stimulants.—Alcohol belongs, with very little doubt, to this class. A whole list of pungent substances, such as the various forms of pepper and the different essential oils, used also to be ranked under this heading, and the *raison d'être* of the various condiments used with our foods was drawn from that consideration; but the recent researches of Engel and Buchheim throw great doubt on the accuracy of this view, and therefore drugs of this class are beginning to disappear from prescriptions which aim at increasing the amount of gastric juice.

Ipecacuan seems, however, to have established a claim to be considered a stimulant of this kind, and sixteen to thirty drops of ipecacuanha wine may sometimes be advantageously added to the last prescription.

CHAPTER IX.

PRIMARY INDIGESTION—(*continued*).

C. THE SLIGHT FUNCTIONAL DISTURBANCES AND THE ORGANIC DISEASES OF THE STOMACH.

As my readers may know by experience, there exists a large group of trifling stomach derangements which it would be misleading to name either inflammatory or atonic dyspepsia, for though, strictly speaking, they may now and again belong to passing attacks of one of those forms, yet in the majority of cases they seem to depend on an accidental decomposition of the food consumed, or on some passing nervous derangement, or on some other transient and trivial cause. At the same time, in a book such as this, it would be unwise to ignore them altogether, since they both constitute conditions for which persons, as a rule, impatiently demand relief, and are of frequent occurrence.

I shall divide them into three groups: the first marked by excessive or diminished desire for food; the second by the development of acids and flatus or wind in the stomach; and the third by certain forms of nerve-derangement in connection with the stomach.

Group I.

Excessive Hunger and Thirst.—With regard to the sensations of hunger and thirst, we must clearly understand that the natural call for food and drink comes from the body at large, and manifests itself only by certain sensations in the stomach and throat.

The stomach is, so to speak, but the bank where the money is paid; the body is the company that stands in need of financial assistance. Were our stomachs to be removed, we should still feel hunger and thirst in the region of the body where that organ was formerly situated, though we should not feel it to the same extent. We shall therefore not be surprised to find that in most of the cases where intense hunger and thirst are experienced, it is not the stomach which is at fault, but the whole system, which is, so to speak, demanding the wherewithal to keep up that moving equilibrium which is necessary for its cohesion, for its very existence, as an organic whole.

Sometimes, especially in certain forms of insanity, as in senile dementia, the nerve-centre in the brain which presides over the sensations of hunger and thirst (for every function of the body has its ruling centre, its so-called head department, in the brain) is *directly* affected, probably by becoming bloodless, as it would if the whole body were starving; and the result is that, though the body may be well nourished, an excessive and insatiable craving for food may be present. The same state of matters, due to the same cause, is seen in some cases of water on the brain in infancy, in some cases of epilepsy, and occasionally even in hysteria.

Again, any unnatural drain on the solids or fluids of the body may be the origin of the excessive demand for food and drink. An instance of this we see in diabetes, where the liver fails to arrest the grape sugar, but allows it all to pass rapidly through its cells and lobules, and so into the general blood-current and away by the kidneys, carrying out of the body with it much of the water in the blood of the patient; the result of which is visible in that craving for food and drink so marked in sufferers from that complaint.

In dysentery, in cholera, and in severe hæmorrhage, we have an equally intelligible demand made by the system at large for water to supply the place of the lost fluids. In summer, again, that lost by the skin's action has to be made up by a larger amount of fluid taken in the course of the day.

But sometimes, on the other hand, an irritated and inflamed state of the stomach is the sole cause of the demand. When we take pungent articles of diet we experience thirst, as does the dyspeptic with an inflamed state of the gastric lining membrane, or the child whose stomach is the abode of a parasitic worm.

The voracious appetite of some weak puny children is the result of a chronic state of inflammation of the mucous membrane of the stomach, and the large amount of food which they consume tends necessarily to make matters worse.

The treatment of all these conditions depends on the cause producing them. To arrest an excessive appetite when it is due, as in young children, to an inflammatory condition of the alimentary track, opium is by far the best drug, for it both checks craving and soothes the affected part. The administration of it should, of course, be placed in wise hands.

Deficient hunger and thirst.—These symptoms, like the preceding ones, are chiefly the result of conditions acting on the brain-centres which preside over and control hunger and thirst. But in place of a deficient blood supply to those centres, which produces, as I have said, a demand for food, we have here the opposite condition—one of congestion, or over-supply of blood to them, which leads to an opposite result—a disinclination to eat. Certain poisons in the blood act also directly on these nerve-centres, not merely congesting them, but actually paralysing their powers. As examples of simple over-supply of blood to the brain, resulting in diminished appetite, we might take the case of the student cramming for his examination, the clerk constantly stooping over his desk, or the worried business man. Headache, which in itself is usually indicative of congestion of some part of the brain, is, as all have experienced, more inconsistent with hunger, than an ache or pain of similar intensity in other parts of the body. In fevers, and in the practices of opium-eating or chloral-drinking, we have instances of the *paralysing* effects on the centres of certain blood-poisons. Sometimes, of course, the stomach is alone at fault. It is the portion of the body where the desire for food is expressed, and any serious derangement of it will generally decrease the demand for food. We see this cause at work in all the chronic forms of gastric dyspepsia. Sometimes, however, an inflamed state of the stomach, when quite recent, will augment hunger, as it almost invariably increases thirst. Deficient thirst is a rare condition. Many dyspeptics of the atonic type avoid, as far as they can, the drinking of fluids, as they suffer a good deal of inconvenience therefrom, which is produced, probably, from a failure on the part of the stomach and intestines to absorb the fluid as rapidly as they would in a state of health.

Treatment of deficient appetite.—The object to be pursued is the removal of the cause which underlies the condition. The wild effort usually made to stimulate a demand for food on the part of the stomach by means of tonics administered indiscriminately, and in almost all conditions of the system in which there is loss of appetite, is unphilosophical, and must be harmful. Fortunately it is not often successful. If people would only learn that the same cause which operates on the hunger-centre of the brain, gorging it and paralysing its power, acts equally, in the majority of cases, on the centres for digestion, which lie quite close to it, they would be saved disappointment and the waste of valuable time spent in seeking to stimulate an unnatural demand for food, and which might be more profitably employed in seeking the cause of the morbid condition, and devising means for its removal, for, by so doing, they would be effecting the simultaneous return of both appetite and digestive power.

Perversion of hunger and thirst.—Examples of this condition are seen in certain affections of the brain and nervous system, in idiotcy, in some forms of insanity, and in hysteria. There can be little doubt that it is usually the direct result of a structural alteration in the centre for hunger in the brain. In pregnancy, an unnatural craving for certain articles of food, such as pickles, green apples, etc., is sometimes observed. This is often the result of stomach-derangement, the irritation from which leads to urgent and faulty nerve-messages to the brain-centres, but it is sometimes solely dependent on the condition of the nervous system.

GROUP II.

Development of gases and acids in the stomach and bowels.—These are usually the products of fermentation. We have seen that the processes of primary and secondary digestion are carried on by means of ferments, and when we come to tertiary digestion we shall have to consider the likelihood of a similar process being in action there; but the reader will remember that ptyalin, pepsin, trypsin, etc., were all *unorganized*, i.e., non-living, ferments. These were incapable of growth and reproduction, and were all similar in action, namely, all possessed of the power to add one molecule of water to each molecule of the substance on which they acted. But, besides that class of ferments, there is another and a larger one, which consists of *organized*, i.e., living, ferments. These are plants, like the yeast-plant, or the bacteria, and of necessity possess powers of growth and reproduction which would be practically unlimited, as long as the medium in which they lived was favourable, did not the products of their fermentative action, when present in large amount, poison them. Thus the yeast-plant, which lives in cane-sugar, if sugar be constantly added, goes on living and producing alcohol and carbonic acid ; but let once the amount of alcohol present equal 20 per cent., and the yeast-plant dies. Most, and it is supposed all, living ferments have their life-period limited by similar conditions. This law is held to account for the fixed duration of certain fevers, the bacteria which cause them being destroyed, as a result of the advancing fermentation which they themselves set up.

Now the chemical action produced by organized ferments is very different from that of the unorganized, and not by any means so simple. I shall not, however, give the exact process in each, which may, if desired, be found in any modern work on practical chemistry, but shall merely remark that it essentially consists in the transference of oxygen from one element, usually the hydrogen, to another, usually the carbon. There are, broadly speaking, three fermentations which food can undergo in the bowel: 1. *The fat fermentation*, which results in the conversion of fat into a highly irritating and offensive acid, called butyric acid ; carbonic acid and free hydrogen being bye-products of the process; 2. *The milk fermentation* which results in the production of grape-sugar and lactic acid ; 3. *The vinegar fermentation*, which alcohol is prone to undergo, and which results mainly in the production of acetic acid, or vinegar.

The above processes, when occurring in the stomach or bowels, produce acids and gases; but the larger amounts of gas which are responsible for what is called flatulence, or wind, result from the effect of the stomach on the air swallowed with food, that organ and the intestine apparently possessing to a slight extent the same power as the external skin of the body and the lungs, of absorbing the oxygen of the air with which they come in contact, and giving off carbonic acid gas. We may, then, make the following list of acids present in the stomach and bowel, the result of the fermentation of food:—

Butyric acid, from fermenting fats and oils. This is produced when food, mixed or cooked with slightly rancid lard, oil, or butter, is eaten. Pastry frequently favours its development by the presence in it of butter which is not of the freshest, with flour that, by reason of its admixture with butter, cannot be digested by the saliva.

Lactic acid, from fermenting milk, and also from sugar. This is regarded by some authorities as one of the normal acids of the stomach. Such a view I hold to be incorrect; but there can be no doubt that both cane and grape sugar rapidly form it, and that hence arises the well-founded complaint made by many persons that all sweetened articles produce in them a development of acid. Cane-sugar seems to undergo this change more rapidly and more frequently than grape-sugar.*

Acetic acid.—This results from the drinking of certain alcoholic beverages. Malt liquors that have not been well kept and very acid wines tend more than others to undergo this change. The great acidity which is such a marked consequence of drinking wines artificially sweetened, such as port and sherry is due to the simultaneous formation of both lactic and acetic acids.

THE ORIGIN OF THE GASES IN STOMACH AND THE BOWEL.

Carbonic acid gas.—Is a result of the effect of the walls of the stomach upon the swallowed air. It may arise also from fermentation in the intestinal track.

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* The formation of lactic acid from sugars is a *natural* change when occurring in the intestines.

Nitrogen.— This gas is left behind when the stomach-wall absorbs the oxygen of the swallowed air.

Hydrogen.—This gas is a result of butyric-acid fermentation, and may unite with the sulphur contained in certain articles of food, forming a highly offensive compound known as sulphuretted hydrogen. This compound is not only offensive to the smell, but when absorbed into the blood may set up symptoms of poisoning.

Atmospheric air, in an unchanged state, may apparently also exist for some time in the stomach, and many hysterical women have a habit of swallowing large quantities of it and belching it—a condition of matters which they will keep up for days or weeks, to the no small terror of their friends. In many of the cases, I am, however, of opinion that the air does not reach the stomach, but is retained in the gullet, whence it is expelled. These cases are very common. I have at present under my charge a woman, of over fifty years of age, in whom the hysterical state developed at the change of life, and in whom this air-swallowing habit is well marked and very persistently kept up. I am convinced that, in whatever way the habit may take its rise, the individuals often end by becoming slaves to it, and by deceiving themselves into the belief that it is a symptom of grave importance.

Elderly people of the peasant class, who suffer from some temporary gastric discomfort, will often aerate their stomachs by a similar process, and seem to derive an immense amount of satisfaction therefrom. It may also be witnessed in persons who are about to be sea-sick. They yawn and swallow some of the inhaled air, and thus precipitate the act of vomiting, but at the same time render it less painful. But when the digestive organs are healthy and strong, and the food suitable, no acid fermentation can commence or progress, and no gas or air can accumulate in the stomach and intestines in sufficient amount to produce discomfort.

As far as foods are concerned, the following may be said to favour fermentation :—

Fats, especially hot fats, or fats that are not perfectly sweet; and such are often used for frying as well as for pastry. Fats in conjunction with flour, or with flour and eggs, which form a compound very prone to undergo both butyric and lactic acid fermentation.

Animal fats are more prone to undergo the change than vegetable ones; for which reason olive oil should be used for frying purposes in preference to lard or butter.

Cane-sugar in excessive quantities, such as in bonbons, crystallized fruits, and sweet wines. Children have a much greater power, apparently, of digesting sugar than adults. In the case of gouty people, whose stomachs are always unduly acid, sugar disagrees very markedly, and where there is a tendency to acidity, the risks of the rapid fermentation of cane-sugar must be kept in view in recommending any dietary. Grape-sugar does not, however, produce symptoms of equal gravity, though it should be remembered that very large amounts of starchy foods, by their conversion into grape-sugar, do occasionally cause discomfort. Sweet wines, such as sweet champagne, port, or sherry, are specially obnoxious.

Badly kept natural wines, and malt liquors that are becoming acid, will also in the human stomach produce acetic acid. Finally, everything that tends to hamper or overstrain the digestive process may set up fermentation in even the most ordinary articles of food.

The *large collections of gas* which are occasionally present in the intestine, and which produce severe colicky pain, are due, very commonly, to fermentation, the result of dyspepsia or of the consumption of improper foods, or else to weakness of the muscular walls of the bowel, which allows of the distension of certain intestinal coils by gas, of which they have not sufficient contractile power to free themselves by forcing it forward. This is seen in many cases of debility, and very markedly in old age.

The treatment of both acidity and flatulence must be carried out on the following lines:—

1 Attend to general health, and observe all hygienic rules.

2. Attend to food consumed, which must be moderate in amount, of good quality, and of an unstimulating character.

3. When an attack of acidity or of colic has developed, take, first of all, a brisk purge to empty the stomach and bowel of the fermenting food, then for a day or two let the food consumed be of the simplest and lightest. In the young, further physicking will not be required; but the elderly, if constipated, can take for a

few days one of the dinner-pills I have recommended in a previous chapter. It occasionally happens, however, that even after the bowels have been emptied as efficiently as possible, some wind and acidity will remain. In such a case the following prescription may be used:—

Salicylate of sodium, 2 drs. (to arrest fermentation);

Essence of peppermint 2 drs. (to excite stomach, etc. to contract);

Chloroform, 1 dr. (to arrest fermentation and soothe);

Compound tragacanth powder, 2 drs. (to make the mixture thick, and to suspend the chloroform);

Glycerine, 3 oz. (to arrest fermentation);

Spirit of sal volatile up to 4 oz. (to dissolve the first ingredient). One or two teaspoonsful in water every quarter of an hour till easy. The bottle to be well shaken each time before a dose is taken.

Or, if the pain be severe and constant, and the patient over the age of 15 years:—

Tincture of chloroform and morphina, 40 drops; oil of cloves, 4 drops; glycerine up to 2 oz. One teaspoonful in a wineglassful of water every half-hour till easy.

Or, in the case of the very aged and debilitated, who are habitual sufferers from constipation, a pill, such as the following, may be taken with dinner daily for a week or two:—

Aloin, 1 gr. (to expel fermenting food); extract of nux vomica, $\frac{1}{3}$ gr. (to assist contraction); oil of cloves, 1 drop (to induce contraction of expanded parts of bowel); hard soap sufficient to make a pill, which should be well varnished or silvered.

Half a teaspoonful of spirit of sal volatile or a few drops of essence of ginger, either of which are best taken in warm water, will often remove flatus if it be confined to the stomach.

Waterbrash consists in the flow from the mouth of a large amount of clear fluid. More than one derangement is, however, covered by this term; thus we have—

1. *Simple Waterbrash*, a condition in which large quantities of fluid, to the extent of many pints a day, flow from the mouth. At night-time the pillow-cases are often quite wet with it. This fluid is *simple saliva*, which is poured out in excessive quantities owing to some derangement usually, but not always, in the stomach, which reflexly affects the centre in the brain which

controls the secretion of the spittle. This fluid is always tasteless. Examples of the simple form of waterbrash are seen in some slight cases of stomach-derangement, in a form of local paralysis affecting one side of the face, and called Bell's paralysis, and a mild form of it may, as we know, be excited by thoughts of food, by smoking, etc.

2. *Waterbrash of a more troublesome kind*, but still due to the same cause, namely, an over-secretion of saliva, is seen in the early stages of cancer of the stomach, in ulceration of the stomach, and in some other severe forms of gastric derangement. In the north of Scotland, it is found that a too exclusive diet of oatmeal will lead to it. In this second class there is both the regurgitation into the mouth of saliva which has trickled down the gullet, and actual retching and vomiting, probably often simply the result of the regurgitation. The fluid regurgitated is generally tasteless.

3. *The third and most severe form of waterbrash* should really not be called by that name at all, as it is due to an excessive secretion of acid fluid by the stomach, which acid fluid is subsequently vomited. This fluid may contain so much hydrochloric and other acids as actually to whiten and scald the lips. This variety is frequently the result of an unnatural contraction at the outlet of the stomach induced perhaps by a scar, the result of a healed ulcer; the effect of this hindrance to the onward passage of food from the stomach being that fermentation of various kinds is set up, and the stomach is enormously distended with acid fluid. This state of matters is, of course, often combined with an increased flow of saliva, and that fact has probably led to its being inappropriately included in the term waterbrash.

Treatment consists in seeking for the cause and endeavouring to remove it. The following mixture gives temporary relief even in the worst class of cases; and sometimes in the simple ones effects a cure.

Bismuth (oxychloride), ½ oz.; bicarbonate of soda, 1 dr.; glycerine, 2 oz.; water up to 8 oz.: One-eighth part, three or four times a day in water.

In the form of waterbrash induced by a dietary of oatmeal, an avoidance for a time of this article of food will soon rectify matters.

The tincture of belladonna, in doses of from 5 to 15 drops in water, and taken three or four times a day, will check considerably the flow of the saliva; but both this drug and the use of the prescription I have given may, as a rule, be avoided by the discovery of the cause of the mischief, which in most cases takes its origin in transient stomach-derangement.

NEURALGIC AND OTHER PAINS IN THE STOMACH.

The main function of the nerve-supply to the stomach is, as we know, the preparation of digestive fluid. Nerves of common sensation (or sensitive nerves), such as those which are distributed all over our outside skin, are fortunately rare in that organ, or we should be aware of each article of food as it entered our stomach, and every slight failure in gastric digestion would produce acute and violent pain instead of merely a dull or heavy sensation. Still, under certain conditions, pains of a very sharp and so called neuralgic character are experienced in and over the region occupied by the stomach.

In cholera we have a very marked example of this, though the cause of the pain is here due to a general contraction of the muscular fibres in the stomach-wall, and a consequent pressure on all the nerve-fibres there, and thus can be scarcely spoken of as strictly neuralgic in character.

In gout we have, however, sometimes an instance of real neuralgia of the stomach (the so-called gastralgia). The ordinary attacks of "gout in the stomach" are merely acute attacks of inflammatory digestive mischief; but, apart from these, one sometimes witnesses severe attacks of simple neuralgia in the region of the stomach, which ensue when the inflammation in the joints, or some gouty skin-eruption, has been suddenly and unwisely suppressed.

Again, in hysteria and in that curious form of nervous disorder called hypochondriasis, severe lancinating pains in the gastric region are frequent, and become much worse if the attention be allowed to rest on them. Pains of this nature not unfrequently form, in these complaints, the foundation for real delusions, such as of the existence of beetles, ants, or spiders in the stomach, or even of ideas of a more fantastic nature. It must not, however, be thought that complaints of this kind are purely imaginary. The animals are, of course, not present; but their movements are intensely real to the invalid, and are due to actual disease and a consequent disorder in function of the brain and the nerves which go to and from it. Indeed, both complaints may be said to be mild forms of insanity, and insanity is always the direct result of actual physical disease affecting the brain, and, through it and by means of it, the mind of the individual. There is one complaint with which the reader must be careful not to confound gastralgia, and that is neuralgia of the diaphragm, that great muscle which forms the partition separating the contents of the abdomen from those of the chest. In gouty and rheumatic people, and sometimes in others who cannot be said to belong to either of those classes, a sudden pain of an excruciating character, which seems to pierce the heart, shoots from the front of the body right through into the back. This is neuralgia of the diaphragm, and is a symptom of no great moment, being merely evidence of some trifling general derangement of the system.

The treatment of gastric neuralgia will depend entirely on the cause. If that be gout, a large mustard plaster had better be applied at once over the stomach, and the feet be placed in hot mustard and water. A rapid purge may be taken, and other suitable measures to be described further on, when gout will be dealt with, may be adopted.

In hysteria and hypochondriasis, every effort must be made to cure the general nerve-derangement which underlies both conditions, and the attention of the patient should, as much as possible, be directed *away* from the abdominal organs. Morphina and drugs of that class are to be deprecated in the treatment of these so-called neuroses, for the relief afforded by their use is but temporary, and is succeeded by a still more enfeebled and deranged condition of the whole system. The society of the emotional, the weak, and the sympathetic (all neurotics) must be rigidly avoided, and converse only allowed with those of vigorous and well-balanced minds. If that point can be gained, a cure may often easily be completed by bathing, changes of air and scene, the employment of both mind and body, with perhaps the aid of some simple drugs directed to the relief of the actual and real gastric derangement which is usually present in both disorders.

ORGANIC DISEASE OF THE STOMACH.

In a book intended mainly for the laity, any long disquisition on the different organic diseases of the stomach would be obviously a waste of time, since such complaints are not in any way amenable to self-cure, and require for their discovery and for their treatments the assistance of the highest medical skill. I shall therefore do little more than mention the names of the three principal ones, and give the characteristic signs by means of which they may be distinguished from forms of indigestion occurring in connection with the stomach.

Cancer of the stomach.—The early symptoms are not very well marked, and may be said to bear a general resemblance to those of inflammatory dyspepsia, but the malady progresses so rapidly, that in the course of three or four months there can be no doubt as to its real nature. By that time vomiting, waterbrash, and usually pain, are conspicuous. As the emaciation advances, the cancerous tumour can be distinctly felt with the hands. Vomiting of black altered blood, which, when examined under the microscope, is found mingled with cancer-cells, becomes then a prominent symptom. This constitutes the so-called *coffee ground* vomit of cancer. Constipation is the rule; but diarrhœa may occur, much depending, of course, on the exact site of the tumour. The emaciation, accompanied by greater debility and by still more incessant vomiting, becomes increasingly marked, until, as a rule, within a year or eighteen months of the first symptoms, death occurs either from exhaustion or from a perforation of the walls of the stomach by the ulcerating mass of cancer.

This disease is rare under forty years of age, but is a frequent cause of death in the aged, in whom the symptoms may be painless and obscure. Many deaths which are put down as simply the result of old age are, without doubt, due to this complaint. It is worthy of remark that the late Professor Sir Robert Christison, who always upheld this view, died himself of gastric cancer, the presence of which neither he nor his medical attendants suspected. The treatment is purely of a palliative nature.

Ulcerations of the stomach.—It is not at all unfrequent for the stomach to become the seat of ulcerations. Numerous small, so-called follicular, ulcers, such as are seen on the tongue when the stomach is out of order, are far from uncommon in the course of chronic inflammatory dyspepsia. These, however, produce no special symptoms, and, as they are confined to the inner coat of the stomach, lead to no immediate danger. They are practically unrecognisable by any characteristic sign during life-time. There is, however, one form of ulceration, which, though not of frequent occurrence, is still far from rare, and to the consideration of which we must devote a few lines. It is this disease which is always referred to when "ulcer of the stomach" is spoken of. Some of its more striking characteristics are—that it is single, occurs much more commonly and at a much earlier age in women than in men, and is most common in females between the ages of fifteen and thirty years, whereas in men the period of its occurrence is most frequent between fifty and sixty years.

Causes.—There can be no doubt that its special predilection for young females is to be traced to the bloodless condition so common amongst the unmarried, at the ages above referred to. That the ulcer should select, as it markedly does, female domestics is accounted for largely by the fact that, during this period of bloodlessness, their diet often undergoes a very sudden change from the simple fare of their own homes to the richer and more stimulating food at the houses that they serve. Tight lacing, amongst women generally, may have something to do also with their greater susceptibility to this complaint. This is all the more likely, inasmuch as when the ulcer is seen in the male sex, it occurs usually in those whose occupations compel a more or less sustained pressure on the stomach. Thus clerks and shoemakers are specially prone to it. Both in men and women, however, the ulcer is sometimes, apart from all other causes, the direct result of the accidental plugging of one of the small arteries in the stomach.

Symptoms.—These are alarming and easily mistaken for those of cancer. Pain on swallowing food is the most prominent of them. This is greater than in the corresponding stage of cancer. It is very easy to comprehend that the contact of food with the ulcer should produce pain. When, as sometimes happens, this symptom is not very pronounced, it may be elicited by giving the patient, on an empty stomach, say the first thing in the morning, half a tumbler of water in which a little common salt has been dissolved, or into which a small quantity of black or red pepper has been thrown. The pain produced will be both rapid and severe if an ulcer be present, but will be slight or absent in any other condition. One peculiarity of this pain is its restricted limit. The sufferer can usually cover the seat of it with the tip of one or two fingers, whereas in inflammatory states of the stomach, and in cancer, the pain is diffused over a considerably larger area. Another still more characteristic symptom of ulcer is the frequent vomiting of blood. This is often bright red, sometimes of a dull shade, but rarely *black*, as in cancer. The vomiting of blood is, however, not confined to cancer or ulceration, for it occurs not uncommonly in inflammatory dyspepsia. In the vomiting of blood itself there is no great danger, for, though considerable in amount, it is very rarely sufficient to endanger life. The great source of uneasiness in this disease lies in the ever-present risk that the ulcer may actually perforate the stomach and allow its contents to escape—a condition of matters which, by setting up a general state of inflammation among the coils of bowel, would almost of necessity end in rapid death.

Treatment.—This consists in resting the stomach by the administration of peptonised or pancreatised foods, or by the use of only the simplest of liquid nourishment. Some practitioners recommend that feeding by nutrient enemata only should be had recourse to for the first fortnight: with that view I cannot agree, unless the patient be singularly robust and full-blooded, for otherwise the deterioration of health and strength which ensues will certainly not tend to induce healing action in the sore. When bleeding takes place, or its occurrence is suspected (for the blood may not always be at once vomited), ice in small lumps should be frequently swallowed, and absolute rest of the whole body be secured. The medicinal and general treatment, however, must always be confided to the skilled practitioner.

THICKENING, AND RESULTING STRICTURE, OF OUTLET OF STOMACH.

This rare disease is due either to a chronic inflammatory condition of the stomach or to the contraction produced by the healing of an ulcer. It leads to detention of food in the stomach and its decomposition there, and hence to an enormous enlargement of the cavity. Its symptoms are developed very slowly, and vary according to the amount of thickening and stricture present. Its treatment, like that of cancer, must from the first be placed in skilled hands.

PARASITES.

But one of the fifty odd parasites that infest the human race finds its way into the stomach. That is the so-called round worm, the ascaris lumbricoides of the naturalist. It is in size and general aspect not unlike a garden worm, though its real structure is really very different. In the persons affected with this form of parasite but one worm may be present, though as a rule there are several. I may mention as a curiosity, and as evidence of its extraordinary fecundity, that by competent authorities the female, when mature, is calculated to contain sixty millions of eggs. I have said that it *finds its way* into the stomach; for this cannot be regarded as its natural *habitat*, which is the smaller bowel. After the age of twelve years this parasite is rarely met with, though I have on more than one occasion known, especially in pregnant women, obscure gastric symptoms terminate with the expulsion by vomiting of one of these guests.

Symptoms.—Popularly these parasites are supposed to work great mischief, and to lead to grave disorders. Occurring as they do much more frequently in delicate and badly fed children than in others, it is difficult often to say what symptoms are due to the unsatisfactory condition of the child and what to the parasite itself. Medical men hold very different views on the subject. MM. Rilliet and Barthez, for example, eminent authorities on diseases of children, give the following as very common symptoms traceable to the presence of the ascaris:—"Features at one time flushed, at another pallid, and in some cases of a leaden hue; lower eyelids swollen, and surrounded sometimes by a bluish semicircle; thirst, nausea; appetite diminished, sometimes augmented, often capricious. Tongue often red, breath foul, and pulse irregular. Fever often present, usually mild and remittent, sometimes continuous and high."

Now the above is a formidable indictment, and in many cases it is but right to say that not one of the above symptoms are to be observed. The fact of the matter is, that whenever the stomach, particularly of a child, is kept constantly in a state of irritation, there is no practical limit to the derangements that may be set up. Indeed, in addition to the above list I have seen cases of convulsions, of persistent headache, of neuralgia, of squinting, of delirium and many other nerve-disorders, all apparently due to the parasite, and certainly all disappearing with him; but, I repeat, these grave disorders are rare.

The expulsion of this undesirable guest from the stomach is remarkably easy and simple, so much so that I have often recommended, and do recommend, in cases where only a suspicion exists of its presence, that the undermentioned treatment be adopted. The following powder, given on an empty stomach the last thing at night or the first thing in the morning, rarely fails to effect a desirable relief:—

Santonine, 3 grs.; calomel, 3 grs.; white sugar, 4 grs. To be placed on the tongue, or given in preserve.

In cases where the first dose shows unmistakably that a parasite is present, it will be advisable to repeat the powder once a week for a month or so. For an adult the dose of santonine is five to seven grs., the dose of calomel remaining the same.

The following is a liquid medicine, containing santonine:—

Santonine, 3 grs.; fluid extract of spigelia (pink root) 1 dr.; fluid extract of senna, 1 dr.; glycerine up to ½ oz. The above, as one dose, to be taken on an empty stomach, in an equal amount of water or of syrup.

But when we have expelled the worm our task is by no means finished; for we shall have very probably a recurrence of the mischief, if we do not, by a very simple and unstimulating diet, and by keeping the condition of the bowels good, restore once more the stomach to such a state of health that it will be an undesirable lodging for the enemy.

Besides the parasite just named, other substances, to wit, marbles, coins, glass, etc., may find their way into a child's stomach. While there they do, as a rule, little or no harm; the danger commences when they pass into the numerous coils of the small bowel. If convinced that the foreign substance is yet in the stomach, it is well to give a large quantity of bread and milk or oatmeal porridge, or boiled cabbage, or milk pudding, so as to fill the stomach to its utmost with some soft bland substance, and then to excite vomiting. It is said that on more than one occasion powdered glass, which has many times been used as a poison, has been safely expelled in the above manner. If, however, the article has reached the bowel, it is well to let the child feed largely on somewhat indigestible food, such as figs, prunes, brown bread, currants, and whole raisins, that these may form a soft mass in which the coin may imbed itself, and thus pass with the least irritation through the bowel. At the same time constipation for two or three days is to be encouraged; at the end of which time castor oil, one single large dose, should be administered. In theory both plans are good—are, indeed, the best that can be devised. If, however, the substance swallowed be, by reason of sharp edges, or of the metal of which it is composed, or by any other reason, likely to become arrested in the intestine, or to excite inflammation in its progress, a doctor should without loss of time be consulted. Within the last six months I have had under my care an infant of ten months, who after retaining for ten days in the bowel one of the brass numbers, containing two small projecting screws (a No. 2) which policemen affix to their collars, passed it through without difficulty. I give this instance to show that, however dangerous the substance, there is always, if suitable means be adopted, a good chance of its passage safely through the intestine.

I have now finished my necessarily brief review of the derangements of the stomach. We have seen that in its departures from health there are but three frequent causes at work—*irritation*, producing congestion and inflammation; *weakness*, generally affecting the whole body, and producing bloodlessness and want of tone ; and *organic disease*, resulting often from some unknown antecedent, but not unfrequently from persistent over-stimulation. The first class we treat with *soothing* measures ; the second with *strengthening* ones ; the third with *palliatives.* Then we have, very hastily, glanced at a few prominent gastric symptoms which it would not be perhaps altogether right to ascribe always to attacks of regular dyspepsia, and which we have therefore considered by themselves and regarded as due to some simple and transient cause.

At the commencement of this book I have given a slight sketch of the varieties of disease and their modes of treatment, and have stated that all degenerations of organs are incurable evils, but that all symptoms which characterise mere functional derangements of the body are beneficial in their tendency, and that scientific treatment should aim at the cure of the latter condition rather by imitating the processes which nature sets up than by assuming an antagonistic attitude. Applying this principle to the stomach, we must regard organic dyspepsia and chronic inflammatory dyspepsia in its worst form—that in which actual degeneration of the stomach has occurred—as incurable, and limit our treatment to palliation ; but in the acute inflammatory kind, the dislike to food, the great secretion of mucus, the vomiting, and the diarrhœa we should class as benefits, and set ourselves to imitate them ; whilst in atonic dyspepsia we recognise that the very weakness of the stomach is, in a debilitated body, beneficial, and our aim is to bring the food to the level of the decreased gastric powers, until we can raise the strength of the *whole* fabric of the body.

CHAPTER X.

PRIMARY INDIGESTION (*continued*).

A. DISORDERS OF THE INTESTINES.

In pursuance of the plan of this work, we have followed the food in its natural course from, and through, the mouth to the stomach, and have shown what are the commonest causes of digestive failure in those parts. Let us for a moment presume that everything has gone on well, as far as digestion is concerned, and that we have to do with an individual who has consumed a meal of fat mutton, bread, and salt, with water as a beverage, and let us, in imagination, take a peep at that meal as it will appear, about two hours after it has been consumed, at the point where the stomach joins the bowel. Here we find:—

1. *The fat*, (i.e., the hydrocarbon) *unchanged*, for neither saliva nor gastric juice has any power over it.

2. *The starch*, (i.e., the carbohydrate), which the bread contained, partly unchanged. The rest has been converted into grape sugar by the mouth, and absorbed by the stomach.

3. *The meat*, (i.e., the albumen) partially digested and absorbed by the stomach; a large part of it, however, still remains unchanged.

4. *The salt* taken with the meat, and that which was present in the water, have been probably absorbed by the stomach and have disappeared.

Thus we have presented to view, all the original fat, and about half of the original amounts of bread and meat. These are mixed together into a whitish, somewhat fluid mass, of the consistence of thin gruel, which is called *chyme*. It is pretty clear that if, as was formerly believed, the mouth and stomach were the only organs of digestion, and that the bowel was merely a receptacle for waste, this chyme would pass unchanged from the body, and not only would no fat be absorbed, but a very large proportion of the other foods taken would also be lost—nay, more, that, if any very grave derangement in the mouth and stomach were present, the body would run a very great risk of being rapidly starved.

To guard against waste and danger of that kind, nature has placed alongside the bowel, at its commencement, two organs—the liver and the pancreas, which pour, usually by a common tube, less often by two distinct but contiguous ones, certain fluids into the bowel, to mingle with the chyme and complete the digestion of its fat and of the unchanged starch and albumen, and has further studded the wall of the bowel throughout its entire course, with certain other small glands which have been named, after their discoverers, Brunner's glands (confined to the first six inches of the bowel, *i.e.*, to that part called the Duodenum), Peyer's glands (confined to the small bowel), and Lieberkuhn's glands (present equally in both large and small bowel). These three sets of glands, more especially those named after Brunner, assist the bile and pancreatic fluid in their digestive functions, but the precise extent to which they contribute to those processes is unknown. In considering the derangements of the intestine, we shall have, therefore, to review, first of all, the various abnormalities met with in the supply of bile; secondly, those seen in connection with the pancreatic fluid; and finally, those that occur in the supply of glandular secretion.

THE FUNCTIONS OF THE BILE AND ITS COMMONER DEFECTS.

We have seen that the functions of the liver are manifold. It acts as a manufactory and a storehouse for both grape sugar and digested albumens. It manufactures bile, and acts as a sentinel to the blood system in general, arresting *poisons* that enter with the food, and sending these, in most instances—unless they be specially potent or large in amount, and insiduous in kind—back into the bowel with the bile, which fluid usually destroys their noxious properties. Now, the storage of sugar and albumen, and the manner in which both are dealt with in the liver, belong to secondary digestion, but the secretion of bile belongs to the primary process and therefore finds its appropriate place in considerations dealing with the intestine into which it is poured, and whose digestive powers it materially aids.

1. *The bile emulsionises fat.*—The complete rationale of the process of emulsification would take too long to describe in this place. I may say briefly that its effect is to convert the large globules of which all fat, liquid and solid, is composed, into very much smaller ones ; so small, indeed, do emulsifying agents render fat globules that they, *i.e.*, the globules, can pass easily through the walls of the intestine into the small channels called lacteal ducts, whose special duty it is to convey the fats to the circulation. Emulsification is, however, strictly speaking, a real digestive act, and the ferment, by means of which it is effected, is called *Emulsin.* The powerful effect on fat of bile has been shown by certain experiments of Von Voit, who found that in the dog, when the bile was discharged through a fistula opening externally, but 40 per cent. of the fat consumed in an ordinary day's food was digested, as against 99 per cent. when the bile was allowed to follow its normal course into the intestines. The moral to be derived from such considerations is, that persons who suffer from a deficiency of bile should be restricted in their consumption of fats, for undigested fat rapidly ferments.

2. Bile assists the absorption of fats that have been emulsified by it or digested (as we shall see they are also) by the pancreatic fluid.

3. It prevents decomposition and fermentation in the chyme.

4. It excites contraction of the intestines, and thereby both favours the absorption of the chyme and assists waste material forward to the outlet.*

Such are the functions of the bile, as regards digestion.

Roughly speaking, the bile itself is composed of the following ingredients :—

Bile acids.—In combination with sodium (taurocholate and glycocholate of sodium).

Broken-up blood-cells, which impart to bile its peculiar colour, the so-called bile-pigment.

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* According to Von Wittich, bile possesses a further power of converting starch to grape sugar.

Poisonous and noxious materials.-Oftentimes the result of failure of the digestive function in the stomach and bowels, sometimes taken in the form of drugs. These, in health, are thrown back by means of the bile into the bowel.

Mucus, cholesterin, etc.—These last, together with the bile acids, bile-pigment, and all the other ingredients named—collectively called bile—are excreted from the liver into the bowel, and are eventually expelled from the body, with the exception of the bile acids, which are re-absorbed and used over and over again by the liver.

We shall, I hope, be now able clearly to grasp the significance of a diminished or arrested secretion of bile.

CAUSES OF DEFICIENCY OR ABSENCE OF BILE.

By far the most common cause of an arrested or diminished flow of bile is *mechanical obstruction* of the bile-duct. This obstruction may arise from the presence of a gall-stone in the duct, or from an actual inflammation and swelling of it, due to the passage of very small stones, in themselves too minute to block its channel. Much the most frequent cause, however, is inflammation of the lining membrane of the bowel, which, by the swelling it undergoes, tends to hinder the exit of the bile by the minute opening through which it passes, drop by drop, to mingle with the chyme. Such inflammatory swelling is, as a rule, produced by an extension of a similar state from the stomach, and for this very reason we often witness a mild attack of jaundice, in conjunction with acute inflammatory gastric trouble. The direct result of any such obstruction to the onflow of bile is to produce first a collection of it in the liver, and then the forcing of some of the bile-acids and pigments into the lymphatics (not into the blood-vessels) of the liver, whence they reach the thoracic duct and pass to the general circulation, and tinge the blood yellow.

If a gall-stone be the impediment, there will be most severe and lancinating pain, attended or followed in a few hours, by jaundice. The other causes enumerated produce jaundice, but *no* pain, unless (which rarely happens) growing cancer of a neighbouring organ be present.

There is a *second cause* of diminution in the outflow of bile, of a more important, albeit of a less frequent, nature than mechanical impediment; I allude to a *complete or partial paralysis of the bile-forming function of the liver*, owing to some derangement or disease of the nervous system. This is seen in fevers, in some nerve-diseases, during great mental anxiety, and after severe shock.

We all know how sudden grief, joy, or pain will arrest the digestive power of the stomach. It is certain that such states have an equal effect on the bile-secretion; indeed it has been made the subject of carefully conducted experiments which leave no doubt of the fact. In insanity generally, and particularly in some forms of it, there is a marked interference with the formation of bile, which results, on the one hand, in the symptom of constipation, and, on the other, in the production of that dirty earthen hue and that disagreeable smell so often noticed in the inmates of asylums. The effect of fever in arresting bile-flow would seem at first sight open to considerable exception, since both in typhoid fever and in small-pox we often meet with incessant bilious vomiting, as an early and troublesome symptom. The same may be said of other fevers, yellow and scarlet fever, for example.

Now the question of fever-poison cannot be separated from that of poisons generally, in considering the effect produced by them on the liver, and a full discussion of the various kinds and of the different opinions as to the special result of the contact of each one with the liver would be too voluminous for a work of this nature; therefore I shall confine myself to the following summary:—

Poisons differ in their effect on the liver. Some pass through it straight into the blood-current; others, the majority, are arrested and act more or less as irritants to the liver-cells, which, with their accompanying blood-vessels, enlarge. The first tendency of this enlargement is naturally in the direction of an excessive amount of bile, and to the elimination of the poison with that bile. Therefore, as an early symptom of fever, we often have the ejection from the body, usually by the act of vomiting, of a large amount of that fluid. This symptom is to be encouraged—a fact empirically recognised in the earliest days of medicine; and though the amount of the vomiting, if large, indicates a bad attack of fever, yet the vomiting itself is distinctly beneficial. To this period of liver excitement succeeds one of exhaustion or paralysis, of much longer duration, so that of every fever-poison, as of every other poison which affects the liver substance, it may be said that, viewing the early with the later symptoms, the total result is a marked *decrease* in the amount of bile. Of course, in fevers there are other factors in the diminution of bile at work, altered blood-corpuscles, etc., and what I have stated above is confined only to the direct effect of the special poison present. A *complete* arrest, either of bile formation or of its excretion into the intestine is, however, rarely seen. Such a condition would, in the course of a day or two, end almost certainly in death.

EFFECTS OF AN ARRESTED FLOW, OR A DIMINISHED SECRETION, OF BILE.

Of an arrested flow of bile, the symptoms that of necssity arise are, first of all, *loss of flesh*, the result of the deficient absorption of fat,* and of the general failure of intestinal digestion by the decomposition of much of the food in the bowel. *Flatulence*, due to the fermentation which goes on in the contents of the intestine owing to want of bile. *Constipation, with light-coloured stools*, result of the absence of the bile-pigments from the motions. These latter are further hard and clayey, from the absence of the softening properties possessed by bile. Such are the effects produced in the bowel. As for those on the system at large, the absorption of the bile acids and pigments by the lymphatics leads to symptoms that go by the name of *jaundice*. This condition is characterised by a yellowness of the skin generally, which is most marked in the delicate skin which covers the whites of the eyes. In very bad cases of obstruction in the bile-duct, this colour of the skin may deepen from yellow to green, or even assume a blackish hue. The tongue is sometimes furred, but, quite as often, perfectly clean. The urine is yellow, green, or even black, owing to the bile-pigments in the blood finding an exit by the kidneys. The perspiration, and even the tears, may, in bad cases, possess a distinctly yellow tinge.

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* As shown by the appearance of undigested fat in the motions.

Besides the effects on the bowels, skin, and kidneys, we have in all cases of jaundice, to take into consideration the effect of the presence of a quantity of foreign material, bile, in the circulation of the blood. Three marked results, due to its presence, are observed :—

First: *on the heart*, whose action is slowed, and sometimes rendered irregular.

Second : *on the nervous system*, which is depressed, as evidenced by lassitude, weakness, drowsiness, and often depression of the spirits. Sometimes stupor, passing into complete unconsciousness is seen. The temperature of the body is also lowered, owing probably to the effect of the bile pigment and acids on the centre in the brain, which regulates the temperature, or possibly to direct interference with the cumbustion of foods.

Third: *on the body at large*, as evidenced by general derangement and loss of tone.

Such are among the commoner symptoms of an obstructed or arrested bile-flow. In the vast majority of cases, the obstruction is very slight, and due, as I have said, to a mere swelling of the mucous membrane at the point of contact of the bile-duct with the bowel. In such cases the symptoms are very mild; trifling and transitory jaundice, a little constipation and flatulence, some depression of spirits, and the passing of light-coloured stools being the only signs of disorder, and these, by the patient, are accurately ascribed to "sluggishness of the liver." All disappear probably with a few purges and a restricted diet; but they will persist, if the causes which have led to the inflammatory swelling of the bowel be allowed to remain in action.

The signs by which *an arrested formation* of bile by the liver are known are often much more difficult to read. There is, of course, *no jaundice*, but there are present in the bowel many of the symptoms which I have already detailed as dependent on a want of bile; but these are often not prominent. As a general rule an unusual amount of constipation, with the passage of light motions, depression of spirits, inability for exertion, failure of appetite, and a furred morning tongue, are among the concomitants of a mild attack, such as is due to a want of outdoor exercise or to worry and fatigue of some unusual kind. In advanced fever and in severe mental disease it is difficult to distinguish the symptoms referable to the absence of bile from those due to the special fever-poison or to the brain lesion present.

THE BILIOUS DERANGEMENTS OF TROPICAL CLIMATES.

In India, and in hot climates generally, the European, especially the Anglo-Saxon, suffers much from various derangements of the functions of the liver. There are two distinct sets of causes at work to account for these. *Firstly*, malarious fevers are common, and the agues of India, like the diseases of that class all the world over, are accompanied by a periodic increase in size of the liver and spleen, corresponding to the shivering stages, and which may recur daily, or every second or third day, or even at irregular intervals. This constant irritation of the liver leads to alterations in its structure which tend, in the long run, to hinder it in the performance of all its functions—that of the proper manufacture of bile amongst others.

The fact that the dark races do not suffer from malarial disease equally with the Europeans may be attributed to their having become, in the course of time, inured to this form of disease, just as in Europe we, or rather our constitutions, have become accustomed to measles and to small-pox, both of which diseases are very fatal to the dark races. Their simpler form of food may also have something to do with the comparative immunity from liver disease which nations of tropical countries enjoy. *Secondly*, there come into operation a whole list of habits and special conditions, climatic and other, unfavourable to the white man. The depression of the nervous system, the result of the heat, acts on the liver, causing it, like all other organs of the body, to lose its normal tone. To counteract these depressive influences at work, the European often, very foolishly, resorts to alcoholic stimulants, which in the long run only make matters worse. The heat, again, renders much active exercise impossible, and this, combined with the deficiency of oxygen in the atmosphere of tropical climates, tends to favour a sluggish or retarded action of the liver. Then the excess of moisture often present in the air checks the necessary evaporation from the skin and throws all the excretory work on the liver and kidneys.

Finally, the diet which the European adopts is usually such as he found suitable at home, but which in a tropical climate, without any other malign influences at work against him, would alone suffice to induce a revolution in the digestive system. The food taken is usually grossly in fault, both in amount and kind, the fats and starches, the great heat-producers, being consumed in excess of the bodily requirements, and the albuminous elements being also far in advance of the needs of men who are debarred from taking much active exercise.

Without for a moment suggesting an actual imitation of the native dietaries, the European might with great advantage read, from the contemplation of them, a physiological lesson as to his *real* bodily needs. The Englishman, as a rule, ridicules such a proposition, believing steadfastly in the popular error, that the weakness of the resisting powers in savage races is due to deficient food. This view has its main support in the fact that the Englishman associates a limited and very largely vegetarian dietary almost exclusively with India, especially with the tribes which inhabit the plains, and not with the highly muscular Turkish porters and soldiers, with the Arabs, with the Bolivian troopers, with the copper-miners of Chili, and with the negro and other black races of Central and Lower Africa; with the Russian, French, Polish, and Spanish peasant, and with the hardy inhabitant of the rural districts of Scotland, all of whom are, compared with the Anglo-Indian, exceedingly temperate, and almost purely vegetarian, feeders, and all of whom can compare favourably in point of physical strength with the Anglo-Saxon.

I have made the above remarks on the causation of liver and stomachic derangements amongst the English inhabitants of tropical climates, because the subject seems to be but little understood, much, far too much, being ascribed to the climate, which, as regards India at any rate, though not conducive to longevity, is certainly not so incompatible with a thorough enjoyment of good health as many Anglo-Indians would have us to believe.

The liver-derangements of hot climates tend always in the long run, like all other unfavourable causes acting on that gland, to a diminution in the amount of bile formed. The rule that over-stimulation of an organ leads to its premature degeneration, accompanied by a gradual decrease of power, knows no exception. Each portion of the body seems to possess a share of that vital energy which the ovum obtains at the time of conception, and on the economy observed in the expenditure of which depends the subsequent life-history of that organ.

But, to proceed with the general question of liver incapacity, supposing that we have to deal with a case of obstruction to the passage of bile—and these cases present themselves almost daily to the busy medical practitioner,—how ought we to proceed? Our first aim should be to remove the cause of the obstruction. If this be a gall-stone, it will as a rule be advisable, without delay, to summon medical assistance, and if the case be so severe as to threaten a fatal issue, to decide quickly upon an operation, with the object of removing the stone. But as cases calling for such extreme measures are rare, it will suffice in the vast majority of cases for the patient to lie down, to place himself on a very low dietary, such as one of water gruel, or barley water, or skim-milk, and of some thin meat tea; to cause a succession of very hot poultices to be placed over the seat of pain; to have the region of the bile duct, to which the pain is generally an unerring guide, well kneaded every three hours, for half an hour at a time, in a direction from right to left, and to take some one of the bile stimulants.

If the suspected cause of the obstruction be a mere inflammatory condition of that part of the intestine in which the bile duct empties itself, treatment such as that recommended for acute inflammatory gastric dyspepsia will be, as a rule, most suitable; for the intestinal mischief has, in almost every case arisen from, and is a direct continuation of, an identical state of matters in the stomach. If gouty inflammation of the bile duct be considered likely to exist, we must have recourse to the ordinary antidotes to gout. If, as will sometimes happen, the mischief seems to be the direct result of a chill, the application of linseed poultices, or of mustard plasters, or even a few leeches or a blister over the region of the bile duct may be necessary.

But whatever be the cause, if there be an attack of jaundice, with or without accompanying pain, it will be advisable to rest, to take some mild aperient if the bowels be constipated, as they are almost sure to be, to follow this up by some special form of medicine which will act directly on the liver, in very many cases to apply poultices over the region of the liver, and in all cases to adopt a dietary in keeping with the diminished power of digestion. The following articles of food must be especially avoided:—Fats and oils, to any large extent; eggs, which are very apt to disagree in these cases; vegetables, particularly of the cabbage tribe, as such have even in health a tendency to give off offensive gases in the bowel; turnips, carrots, parsnips, and beet-root being amongst the best to partake of. Unskimmed milk, koumiss, buttermilk, skim-milk, or whey may be taken. Butchers' meat must be used very sparingly, but thin meat broths, from which the fat has been carefully skimmed, may be taken in moderation. Twice-cooked meats, pickles, pastry, sugar, cheese, malt liquors, sweet wines, or spirits, and all other notoriously indigestible articles must be carefully shunned.

Our next aim in treatment will be to lessen the risk of further intestinal mischief. This will be achieved by carrying out the dietetic and other rules that I have laid down.

Finally, we must seek to promote a proper flow of bile. This is precisely what nature has been striving to do. The agonising pain experienced in the passage of a gall-stone is but the result of unusual effort put forth by the muscular tissue in the bile duct, the object of which is to hurry forward its unwelcome guest. The jaundice which has resulted from such, or similar, obstructions has saved the liver and its cells from otherwise certain destruction by over pressure, and the patient from a rapid death, by providing the bile with a means of escape. The loss of appetite which the sufferer deplored, as well as the concurrent failure of the stomach and intestine to digest, has saved the liver from a large quantity of sugar and albumen, which, in its engorged state, it could not possibly have managed to deal with in an efficient manner. The high colour of the urine is evidence of the fact that the kidneys are assisting to carry off bile from the blood. Nay, the stupor, and even the very unconsciousness which may come on in the later stages of very bad attacks, are doubtless, if the truth were known, beneficial and comparable to those local dropsies, such as occur in Bright's disease and in heart failure, and which, though they may seem to be unmitigated evils, are in reality final efforts made by nature, even at the last moment, to save the general equilibrium by drawing fluid from the distended and bursting blood-vessels.

All the symptoms, then, observable in a case of disturbed bile flow are due to efforts to overcome the impediment, or at least to save the body from destruction by the necessary and natural results of the obstruction. We shall therefore be acting wisely if, as far as possible, we seek to aid nature in promoting the flow of bile into the bowels, and in disgorging the liver, and this we may do by administering one or more of the following drugs, which tend to increase the flow of bile, and thus help to bring pressure to bear from behind on any obstruction in the bile-duct:—Podophyllin, euonymin, aloes, colchicum, iridin, sanguinarin, ipecacuan, colocynth, phosphate of sodium (or tasteless salt), phytolaccin, phosphate of ammonium, salicylate of sodium, dilute nitro-hydrochloric acid, corrosive sublimate, baptisin, scammony and Glauber's salts.

But it must be remembered that even if we produce an increased flow from the bile duct, the extra bile will, unless we take measures to prevent it, be re-absorbed and go back to the liver. We must therefore combine with the above some drug or drugs which will act also on the walls of the intestine and on the small glands in it, and will thus promote the rapid expulsion from the body of the bile after it has been poured into the intestine. The following are amongst those which possess to a marked extent that power:—Calomel, Epsom salts, castor oil, sulphate of manganesium, ipecacuan, chloride of ammonium, colocynth, baptisin, scammony, and Glauber's salt (sulphate of sodium).

It will be remarked that some half dozen of the drugs enumerated possess the dual power, and, *à priori* it would seem that there could be nothing easier than to give one of such drugs in a suitable dose, to attain the desired end. But, as I have said in an earlier part of this work, drugs have many-sided actions, and we must therefore be careful to select for practical use only those which can be given without producing unfavourable collateral effects.

For the fairly robust, I can, from personal experience of their efficacy, confidently recommend some one of the following formulæ :—

1.—Calomel, 1 gr.; podophyllin, ¼ gr.; extract of henbane, 2 grs.; compound colocynth pill, 1 gr. This pill to be taken at bedtime.

2.—Euonymin, 2 grs.; extract of henbane, 2 grs. One pill to be taken at bedtime.

3.—Euonymin, 1 gr.; iridin, 4 grs.; extract of henbane, 2 grs. Divide into two pills. Both at bedtime.

4.—Podophyllin, ¼ gr.; leptandrin, 1 gr.; extract of henbane, 1½ gr.; glycerine of tragacanth, enough for a pill. To be taken at bedtime.

It is, in the case of all the above compounds, useful to take a small seidlitz powder the following morning before breakfast, to ensure a complete evacuation of the bile produced by them.

1. Glauber's salt, 2 oz.; common salt, half a teaspoonful glycerine, 2 oz.; spirits of peppermint, 1½ drs.; water to 8 oz. One-eighth part in plenty of water thrice daily.

2. Epsom salts, 2 oz.; carbonate of magnesium, 2 drs.; Glauber's salts, 1 oz.; glycerine, 3 oz.; peppermint water to 8 oz. One-eighth part twice a day.

With either of the above mixtures, small powders, each consisting of two grains of grey powder, should, placed on the tongue, be taken three times a day.

In the case of very delicate people and ladies, pills Nos. two and three can be taken, or one of the following medicines :—

Dried phosphate of sodium, 1 oz.; water to 8 oz. One-eighth part in broth, or any convenient fluid, four times a day.

Or one teaspoonful of granular effervescing sulphate of sodium two or three times a day.

Hunyadi Janos, Friedrichshall, or Pullna water, in doses of from one to three wineglassesful, may be taken in warm water twice a day.

In infancy and early childhood jaundice is rarely seen, for the yellow discoloration of the skin occurring in many newly-born children cannot be classified as such in the usual sense of the word.

In cases of true jaundice occurring in infancy and early life, one of the following will be useful :—

Calomel, 2 grs.; white sugar, 3 grs. This powder to be placed on the tongue, and the dose to be repeated for three or four nights, if jaundice persist.

Grey powder, 3 grs.; jalapin, 2 grs. To be given in white sugar or in preserve, and to be repeated, if necessary, three or four nights.

Whilst the above powders are being given, it will be well to administer also a tablespoonful of Dinneford's fluid magnesia once or twice a day.

In chronic cases, the following mixture is good for adults:—

Chloride of ammonium, 2 drs.; spirits of cajeput, 1½ drs.; fluid extract of liquorice, 6 drs.; syrup, 2 oz.; glycerine, 2 oz.; water up to 8 oz. One-eighth part in plenty of water twice a day, for a month or six weeks in succession.

To remove the staining of the skin that persists in some cases even after the jaundice has disappeared, benzoic acid lozenges, two, four times a day, may be taken for a week or ten days.

The following mineral waters are of service in the treatment of chronic cases:—Cheltenham, Leamington, Bridge of Allan, Carlsbad, Ems, Friedrichshall, Kissingen, Aix-la-Chapelle, Marienbad, Pullna, Vals, and Vichy.

But I have stated that sometimes an arrested flow of bile is not due to any mechanical obstruction in the main bile duct, but is the direct fault of the liver, and traceable to want of power in that organ. Such cases are not marked by jaundice, though the deficient amount of bile in the intestines gives to the other symptoms a strong likeness to those which result from obstruction. When this state of matters is associated with, and the direct result of a fever, our efforts will be of course directed to cure or to mitigate the severity of the fever; but if they be due to simple weakness, to badly formed bile, or to some derangement of the nervous system, our best means of cure at command are the purely hygienic ones: of these, exercise is the best. Walking, cycling, running, and riding have a very direct effect on the liver, through the increased action of the diaphragm muscle which they induce, and which increased action has the effect of actually pressing and squeezing the gland, thus emptying it of any dried or thickened bile that may be blocking its smaller ducts. Prolonged kneading and percussion over the liver have also, in cases of this kind, yielded in my hands brilliant results.

In bad cases, a short sea voyage—Southampton to Havre, for example—is often most beneficial; and I have known cases in which the bile was deficient, the liver sluggish, the whole digestive system torpid, and in which severe mental symptoms of a hypochondriacal, and even of a really delusional type, had begun to manifest themselves—results of the defective bile formation, all of which yielded rapidly to severe sea sickness.

In some cases oxgall may be administered. It supplies artificially the necessary bile, but it must always be remembered that, like pepsin in gastric disorder, it does not tend to cure the patient, which is the aim of all scientific and rational systems of medicine. The following are the best modes of administration:—

Oxgall, 5 grs. in gelatine capsules, or in keratin coated pills, each pill containing 2½ grs. Two of the capsules or four of the pills to be taken an hour after dinner, and one of the capsules or two of the pills half an hour after any other full meal containing any fatty substance, such as butter, unskimmed milk, cocoa, meat, etc.

EXCESSIVE EXCRETION OF BILE, OR ACUTE BILIOUSNESS.

This condition, which is commonly referred to under the name of an attack of bile, occurs frequently in hot climates, as a result of the stimulation to which the liver is often subjected in those regions. In England, and in temperate zones generally, a similar state of matters is less frequently witnessed. These attacks are, as a rule, periodic, recurring at somewhat regular intervals. The persons prone to them are nearly always of a certain fixed type, to which the name of Bilious Constitution or Temperament has been given. In such the hair is dark and strong, and does not fall out early in life; the bodies are of middle stature, or below it, well-proportioned; the features are generally regular; the skin is thick, and has sometimes a tendency to be dark or sallow in hue; the circulation is strong; the character is determined and energetic. In persons of this temperament fat and sugar always disagree, if they be taken in large amount. Meat is fairly well digested, and starchy foods are not, as a rule, complained of. This type of persons form a very interesting study, in so far as their complaint is concerned. Every now and again—it may be once a fortnight, once a month, or once a year,—they begin to experience the well-known symptoms of a commencing attack. Sometimes a slight shiver is the first sign; then come nausea and sick headache, accompanied generally by great depression of spirits and complete loss of appetite. Giddiness and vertigo are not uncommon. The sight is also frequently affected. Sleep is almost banished, or is imperfect, and accompanied by painful dreams. This stage may last a few hours, or a few days. On it there supervenes, sooner or later, the second stage, one marked by vomiting or purging; sometimes by both. The vomit and the motions are distinctly bilious in character. To this stage succeeds relief and, in a day or so, complete recovery.

Now for an explanation of the attack, and for rational means of prevention and cure. The liver possesses three great functions. The first has to do with the storage and subsequent supply of grape sugar to the body. When this function is paralysed, diabetes results. The second has to do with the preparation of albumen (nitrogenous material), carried to it, like the sugar, by the portal vein. This albumen is partly converted into serum albumen, for the nourishment of the cells of the body; a bye-product called urea, destined solely for elimination by the kidneys, and subserving no known useful purpose in the body, resulting also from the process. When this conversion of part of the albumen into serum albumen and urea is not efficiently carried out, gout results. The third function refers to the destination of the balance of the albumen brought to the liver. This goes to the formation of bile; and when this process is not efficiently carried out, biliousness results.

Now, gout and biliousness, both of which depend on the digestion, in the liver, of albumen, are, as we should expect, very closely allied, and not by any means unfrequently simultaneously present in an individual; sometimes again on the subsidence of periodic gout, periodic biliousness will replace it; or, *vice versâ*, biliousness will, in some individuals, take the place of gout. The causes of both diseases are alike. 1. Hereditary tendency to failure of the liver in its function of dealing with albumens. 2. Overwork of the liver, producing a breakdown of that organ, by exhausting its powers. 3. Underwork of the liver, due to a general debility of the whole body, which results, like No. 2, in exhaustion of the liver. 4. Derangements of the nervous system.

The hereditary tendency is, however, in both complaints, nearly always present, and is merely brought out by such unfavourable conditions as are enumerated under Nos. 2, 3 and 4. The biliary function of the liver would, however, seem more susceptible to derangement than its other functions, since one sometimes witnesses typical bilious attacks even in young children, at ages when distinct gout or diabetes are practically unknown.

Now let us consider two or three types of bilious people.

A possesses all the peculiarities of feature, etc., which mark him out as a bilious man. He takes but little exercise, and eats largely. True, he avoids fats and sweet things, for he regards them as bilious, but he eats meat largely and takes malt liquors, or spirits or wine to assist their digestion. He also partakes reasonably well of starchy substances, and of some kinds of vegetables. Every month or so he is bilious. This he complains of bitterly, for, as he will tell his doctor, he has avoided sweets and rich (*i.e.*, fat) things, which are, he considers, the only producers of bile.

Now let us analyse this gentleman. He has, it is true, avoided fats, for they, owing to the lack of bile in his intestine, are never well digested, and tend, therefore, to ferment and produce a rancid acid (butyric acid), which will sometimes find its way upwards to his mouth. He has also avoided sweet substances; for, owing to the want of that great preventer of fermentation and putrefaction, bile, the cane sugar in these readily ferments, and he has more than once felt the disagreeable sensations due to such fermentation. So the fats and sweets were avoided, not because they could produce bile, but because bile was never present in sufficient quantities to deal with them. Meat, as the substance most rich in albumen, and therefore most bilious, was partaken of largely, and difficult as its digestion is in the healthy, and indifferent as it must be in a man like *A*, its digestion has been further hampered by the presence of alcohol, which may and does assist digestion in some forms of stomach derangement, but which has a markedly deterrent effect on the secondary digestion which occurs in the liver. As we shall see later on, the digestive processes in the liver are very different from those in the stomach, mouth and bowel, in not being brought about by means of ferments so much as by oxidation or combustion; and alcohol to the liver is like straw to the furnace: it burns fiercely and rapidly, absorbing to itself a large share of the oxygen, leaving much ash, and hampering and hindering generally the regular and slow combustion of the more suitable fuels.

A's attacks were *periodic*, because the liver was naturally defective in bile making properties, was hampered by an excess of albumens, and was constantly turning out improperly prepared bile, which did not possess the fluidity of natural bile, and tended to clog up the small bile ducts and to produce general enlargement of the liver—a condition of matters which went on getting worse, until at last an actual stagnation of affairs came round. Then the bile that was formed, having no sufficient exit by the liver passed in small quantities by the lymphatic channels into the blood, and acting on the centres of the brain, set up nausea and vomiting, which by unloading the liver, cured *A*, who otherwise must, but for the beneficial process of which he so bitterly complains, have rapidly died, or at least have become the subject of some graver ailment.

Now let us take a somewhat opposite case.

B is a girl of 18. She lives in small rooms, and serves as a draper's assistant in London. In the evening, gas is burnt in the shop for four or five hours, which makes the place at once hot, stuffy, and draughty. Active exercise in pure air she never gets, never dreams of, never wishes for. Her food is scanty, and the time devoted to the eating of it, quite insufficient. To improve her health, she sometimes walks home of an evening, some two miles, but she finds that the walking only makes her worse. She becomes pale, breathless, and finally very bilious, vomiting large quantities of green and yellow bile. Her state forms a strong contrast to that of *A*. She is not of necessity dark-haired, is not therefore of the real bilious type. She may be plump, even remarkably so. Her attacks of biliousness are not periodic. This is her first attack, and it has lasted some weeks and shows no signs of going. She is very pale, and an inspection of the gums makes it evident that her blood is very deficient in red corpuscles. Now, in *B*'s case, the liver has, owing to the unhealthy conditions under which *B* lives, and the great demands made on her strength by the changes which her body has to undergo at the commencement of womanhood, simply broken down. It cannot efficiently deal even with the small amount of albumen it receives, and the supply of red blood corpuscles necessary to perfect bile formation is wanting. The liver, as in *A's* case, has become at last gorged with imperfectly made bile, and the same mechanism as in his case has at last set to work to rid it of its contents. And with the liver, the stomach has also broken down in function, and food excites pain and further vomiting.

Now let us take one more case, that of *C*, a man of thirty-five, whose digestion has given him but little trouble hitherto. Recently, however, the nature of *C*'s employment has changed. He has now a great deal of sedentary work to get through, and finds that the unaccustomed working at figures all day bothers him, and produces headache. His appetite fails. His spirits get low. He begins to take gloomy views of everything, and loses all heart and interest in life. At this period he goes out to dinner, and is tempted to eat of several rather rich dishes, and to drink several glasses of sherry. Next day he is very sick, and vomits a very large amount, first of fermented foods, and then of bile. Towards evening, he gets better, and the following day feels lighter and clearer than he has done for months.

Now let us consider the question of treatment. *A*, the typical bilious man, should be treated as follows:—

Exercise.—Riding, walking, running, tricycling, rowing, swimming, gymnastics, etc., are all good for him, and will stimulate his liver to pour out a regular supply of bile, and will prevent the clogging up of the small bile ducts, for in any of the exercises recommended, the diaphragm muscle will several times a minute come down powerfully on his liver, and squeeze it.

Plenty of water and of salts.—These are necessary for the production of proper bile. The salts are best obtained from ripe fruits and vegetables.

Limited meat supply.—The vegetable kingdom had better be depended on for the supply of necessary albumen. All seeds yield it in abundance. Meat may, however, be taken, but not more than once a day, and must be then of the most digestible kinds; poultry, mutton, and white fish (for fish is dietetically a meat) are the best.

Alcohol, especially malt liquors and sweet wines, to be avoided.

Bowels must be kept regular.—This to be effected by food and exercise, not, if it can be avoided, by drugs.

Bathing may be freely indulged in.

Worry and anxiety to be avoided as far as possible.

If *A* will follow this advice, his bilious attacks will probably never again trouble him, and, more than that, he will very possibly find, after a time, that he can digest without trouble as much fat and sugar as most of his fellow-men.

Now for the treatment of *B*. *Rest*, *pure air*, and *strength* are her requirements. A few weeks at the seaside or in the country will do her a vast amount of good, and will enable her to take and to digest food which will supply her with all the blood she stands in such urgent need of. When she has secured these desiderata, the biliousness will disappear of its own accord. But in this case we can supply two of her great requirements in the way of food—iron and salts, both necessary constituents of the human body, and both sadly wanting in her case. Let us give her the following mixture:—

Steel drops, 2 drs.; chloride of ammonium, 2 drs.; spirits of chloroform, 3 drs.; glycerine, 4 oz.; water to 8 oz. One tablespoonful in water three times daily. The mixture to be taken regularly for five or six weeks.

In three or four weeks the colour of the gums will be wonderfully altered, the breathlessness will have gone, digestion will be performed without pain, and all traces of biliousness will have fled.

The treatment of C.

A restricted diet for the amount and kind of food required when at work in an office is different from that needed when actively engaged out of doors. A breakfast of porridge, bread and milk, or hominy, or simply of toast and butter, with tea or coffee. A lunch of a few sandwiches, and a glass of light ale, or a cup of coffee or cocoatina, with a little fruit afterwards, if possible. A dinner, after the day's work is over, consisting of a plain joint and a milk pudding, or a little fruit. Claret and water, or plain water as a beverage. A walk after dinner, and a snack before going to bed. No nightcap in the way of alcohol to be allowed. Smoking to be confined to one single pipe after breakfast, and two after dinner.

Exercise.—As much as can conveniently be taken.

Bathing to be regularly carried out. A tepid or cold bath daily in summer, and a swim once or twice a week. In winter a weekly hot and a daily tepid bath.

Drugs.—A pill of euonymin or podophyllin, may occasionally be had recourse to.

I have given a brief account of biliousness, and I regret that a regard for space compels me to leave this, to me, highly interesting subject. To one thing I will again draw attention. Biliousness is beneficial ; is an effort of the liver to recover health, *i.e.*, equilibrium. After a severe bilious attack the patient feels clearer and better. But let him who possesses understanding look on biliousness as a rebuke and a warning. The elasticityof his liver is still good, but the *elasticity of no solid body* is perfect. If by a persistence in evil he force on many and frequent bilious attacks, he will exhaust the elastic power and the *attacks will cease*, but they will give place to a worse condition, probably that of gout, and, *as far as the liver is concerned*, gout is more of a degeneration than of a beneficial elastic recoil. Even in gout there is hope; but the road to recovery is rougher and longer.

BILIOUS VOMITING (PSEUDO-BILIOUSNESS).

There are a great many varieties of so-called bilious attacks which are not of the nature of true billousness. This confusion of terms arises from the fact that in all attacks of violent vomiting, bile may appear. This is seen in sea-sickness. The motions of the ship excite contractions, etc., in the stomach wall which end in the ejectment of its contents. A continuance of the causes at work leads to a second or third act of vomiting, till the stomach becomes empty and collapsed; every effort at vomiting will then tell directly on the liver; bile will be forced mechanically into the upper part of the bowel, and thence some of it will find its way upwards into the stomach, and bē ejected. A continuance of the retching will lead to the appearance of more and more bile, and eventually to bilious diarrhœa..

In acute gastric catarrh the same sequence of events is sometimes observed; but the appearance of the bile in the vomit does not in these cases imply any derangement of the liver, though such may sometimes be present, but merely testifies to the severity of the vomiting. Much, again, of the so-called bile which people throw up is merely acid fluid, resulting from the fermentation of food in their stomachs. These states are not to be confounded with real biliousness; and though in them, as in real biliousness, the process of vomiting is distinctly beneficial, the treatment to be adopted is, of necessity, of a different kind.

THE PANCREAS.

This very important gland, which in structure and in its methods of response to electric stimulation, bears a close resemblance to the salivary glands, is situated just below the stomach, and pours its digestive fluid, usually with the bile, into the upper part of the bowel.* This digestive fluid is an epitome of all the others. It contains, for example,

1. *Trypsin,*† which, like pepsin, digests albumens.

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* Sometimes the bile duct and pancreatic duct open separately into the bowel, as depicted in the diagram at the commencement of this book. More frequently, however, the two ducts join, and have one common entrance.

† The only difference in action between pepsin and trypsin is that the former requires an acid state of the fluids it digests, the latter an alkaline one.

2. *Diastase* (or amylopsin), which, like ptyalin, converts starch into grape sugar.

3. *Emulsin* (?), which, like bile, emulsifies fat.

But in addition to the above ferments, it possesses one which no other gland prepares, namely—

Steapsin, a ferment which splits fat into glycerine and fatty acids.

The pancreas, then, possesses and exercises the power of completing the digestion of that part of the chyme which the saliva, the gastric juice and the bile have been insufficient to deal with. Its secretion, like the saliva and the bile, is probably to a large extent re-absorbed, the larger portion of it being thus saved. It may also be fairly presumed that the condition of the stomach influences to some extent the pancreatic, as it does the salivary, flow; but both these points possess as yet only the value of suppositions.

We will now consider the causes and effects of a decreased supply of pancreatic juice. An excessive secretion and excretion of it, like that seen in the liver, mouth, and sometimes in the stomach, though doubtless occurring also with the pancreas, has not as yet been described, nor the symptoms to which it gives rise been isolated.

Causes of decreased flow of pancreatic fluid.—Mechanical obtruction at the point of exit of its duct into the bowel. This state, which impedes the outflow of bile, has necessarily an equal effect on that of the pancreatic fluid. Gall-stones do not, however, except in very rare instances, produce the block at this point, for if they can pass down the bile duct they can always pass on when they reach its junction with the pancreatic duct, as the common tube thus formed is much larger than the bile duct alone. Mechanical obstruction, then, as far as the outflow to pancreatic fluid is concerned, is limited to those inflammatory conditions to which we have referred amongst the minor impediments to the bile.

Inflammations and congestions of the pancreas, such as result from a chill, from direct violence, from extension of the inflammatory process to it from some neighbouring organ, or from certain diseases, as syphilis, produce a diminished supply of the fluid after the first or stimulating effects of the inflammation have passed off. Febrile states lessen the amount, as they do in the case of the bile.

Exhausting complaints of all kinds—consumption for example, produce a lowering of the power and function of the pancreas, sympathetic with that of the whole body.

Results of the above causes.—Wasting, and the appearance in the stools of much undigested fat, the presence of the latter ingredient acting as an incentive to diarrhœa. But since the bile has also the power of digesting fat, it might seem that the appearance of that substance in the stools would not alone be sufficient evidence of a purely pancreatic derangement; but the reader must remember that if the liver alone were at fault, and the deficiency of bile alone responsible for the undigested fat, *jaundice* would almost for a certainty be present. Sometimes, as a result of the pressure of a large tumour or the contraction of an ulcer, the outflow of both bile and pancreatic fluid may be arrested; in such cases jaundice, *plus* a complete arrest of fat digestion, is present, and the wasting of the body is consequently rapid.

Treatment.—This, of course, depends on the cause. If a growing tumour be present, a surgeon should be consulted. If an inflamed state of the mucous membrane of the bowel be the cause of arrested outflow, a low diet and soothing medicines, such as the trisnitrate of bismuth, with poultices externally, and an occasional mild purgative, will be the means that recommend themselves. If the cause be found in a failure of the general strength, or in febrile conditions of the whole body, we must devote our energies to the correction of those states.

Diet.—As regards diet, if we have to do with a diminished supply of pancreatic fluid, we should limit the consumption of fats, or take only those which have been artificially emulsionised or digested. Carnrick's and Savory and Moore's emulsions are amongst those from the use of which I have seen great benefit follow, but others, no doubt equally good, abound.

Then we can avail ourselves of some of the many artificially pancreatised foods. I enclose directions for the process, copied from Landois' and Stirling's "Physiology."

"*Peptonised Milk.*—A pint of milk is diluted with a quarter of a pint of water, and heated to 60° C. Two or three teaspoonfuls of Benger's liquor pancreaticus, together with 10 or 20 grains of bicarbonate of soda, are then mixed therewith. Keep the mixture at 38° C. for about two hours, and then boil it for two or three minutes, which arrests the ferment action.

"*Peptonised Gruel*, prepared from oatmeal, or any farinaceous food, is more agreeable than peptonised milk, as the bitter flavour does not appear to be developed in the pancreatic digestion of *vegetable* proteids.

"*Peptonised Milk-Gruel* yielded Roberts the most satisfactory results, as a complete and highly nutritious food for weak digestions. Make a thick gruel from any farinaceous food, *e.g.*, oatmeal, and while still hot, add to it an equal volume of cold milk, when the mixture will have a temperature of 52° C. (125° F.). To each pint of this mixture add two or three teaspoonsful of liquor pancreaticus and 20 grains of bicarbonate of soda. It is kept warm for two hours under a cosey. It is then boiled for a few minutes and strained. The bitterness of the digested milk is almost completely covered by the sugar produced during the process.

"Peptonised soups and beef-tea have also been made and used with success, and have been administered both by the mouth and rectum.

"Peptonising powders containing the proper proportions of ferment and sodic bicarbonate are prepared by Benger and Burroughs and Wellcome."

I must again remind my readers that artificially digested foods do not cure the condition for which the patient seeks relief, and that they can only be used as temporary expedients to allow both doctor and patient to find time for something more efficacious, or, in cases of malignant disease, to prolong life. Unfortunately we know little for certain of the effects of any drugs upon the pancreatic secretion.

Ether is said to stimulate the flow, and may be conveniently administered in the form of *perles of ether*, four of which may be taken from one to two hours after each meal.

In the treatment of cases of this kind I have derived much more good from the application of Faradic electricity than from anything in the way of drugs.

CHAPTER XI.

PRIMARY INDIGESTION.

B. DISORDERS OF THE INTESTINES (*continued*).

FIRST let us consider the part played in the digestive process by the glands which stud the walls of the bowel. These, as I have already said, are named after their discoverers, Brunner's, Peyer's, and Lieberkuhn's glands. Their functions are supposed to closely resemble those of the pancreas. They represent the *chiffonniers*, the refuse sorters amongst the inhabitants of the country of man. All that has passed undigested the gauntlet of the saliva, the gastric fluid, the bile and the pancreatic juice is submitted, so to speak, to their inspection—is turned over and scrutinised by them, and most of the particles which can be turned to account as food for the body are saturated with their secretion, digested by it and absorbed into the portal vein; the vegetable fibres, hair, horny and elastic tissues, pips of fruit, etc., etc., insusceptible of digestion, together with all excess of food over and above the digestive powers being allowed to pass on and be evacuated.

PARASITES may find a lodgment in the human intestine; and we will briefly consider the various kinds met with and the means to be adopted for their removal.

The *round worm*, to which I have already referred in my chapter on the stomach, has its natural habitat in the upper part of the small bowel. As it cannot, however, live in a healthy intestine, all that is needed after it has been expelled by means of santonin, combined with a purgative, such as calomel, to prevent a recurrence of the trouble is, to see that the diet is simplified and that the stomach and intestines are brought into, and kept in, a healthy state.

The thread worm infests, as a rule, the last twelve inches of the bowel; is never single, but usually present in large numbers. In length it is about three-fourths of an inch, and in thickness and in general appearance it bears a strong likeness to a piece of white cotton. In infancy and in old age these parasites are exceedingly common, and give rise to great discomfort. They are rarely found in middle life. In children, restlessness, local irritation, and a desire to be frequently voiding urine are amongst the commoner symptoms. In old age and in middle life their presence may, in some rare instances, lead to abscess formation in the neighbourhood of the lower bowel, and that again to fistula. Thread worms, like round worms, cannot exist in healthy intestines, and their presence therefore always indicates an antecedent state of ill health, to which no doubt are attributable the train of symptoms often ascribed solely to the presence of the parasite.

The treatment which leads to a cure of this condition is simple.

1. Clear the bowel out thoroughly by means of an active purgative, administered every second day for ten days.

2. Inject into the bowel every day, after its evacuation, a pint of warm water in which two teaspoonsful of powdered alum, or of common salt have been dissolved, or to which three teaspoonsful of steel drops have been added, or soak for twenty-four hours an ounce of quassia wood chips in a gallon of cold water, and use a pint of this solution daily as an injection.

For children a quarter to half a pint of any of the above injections may be used.

3. After the ten days course is finished (and in mild cases in half that time), discontinue the use of injections, or use them only at longer intervals; and if the health be low, take a simple tonic such as one of the following:—

For adults:—

Steel drops, 1 dr.; infusion of quassia chips, 6 oz. One tablespoonful in plenty of water, to be taken thrice daily, after food.—To be continued for two or three weeks.

For children, from three to ten years of age:—

Tincture of nux vomica, 40 to 60 drops; dilute nitro-hydrochloric acid, 1 dr.; glycerine, 1½ oz.; cinnamon water, up to 2 oz.—One teaspoonful three times a day in water.

For the aged:—

Aloin, ½ gr.; extract of nux vomica, ¼ gr.; extract of henbane, 1 gr.—Twelve such pills to be made. One twice a day, after the principal meals.

4. The diet must be free from all highly stimulating ingredients and from excess of sugar. In children and in the aged it is well to limit very carefully the supply of meat, or to order its complete withdrawal for a time, and to substitute for it vegetables rich in albumen.

Tapeworm.—This, the most formidable in size, in the mischief which its presence causes, and in the difficulties which attend its removal, is, in Great Britain at any rate, not a very common parasite. The tapeworm passes, as many of my readers are doubtless aware, through several metamorphoses in its development, reaching man through the medium of the flesh of the pig or the ox. As cooking, however, destroys the undeveloped worm, it follows that the risk of becoming the host of one of these undesirable guests is very small indeed, if all pork and beef be, before their consumption, subjected to thorough roasting, baking or boiling. In Germany, Switzerland, Poland and Russia, where ham and beef that have undergone the processes of smoking or drying only, are largely consumed, tapeworms of various kinds are of very frequent occurrence.

The Symptoms produced by the presence of this parasite are very various. Sometimes no discomfort of any kind is experienced; in the majority of cases, only vague signs of dyspepsia, accompanied occasionally by twisting pain, of no great severity, in the region of the navel, are complained of. Of course, when once the patient becomes aware that he is suffering from tapeworm, he will ascribe every bodily derangement for the whole antecedent period of his life to its presence, but in cases where its existence is unsuspected, no great complaints are, as a rule, made. Now and again, however, one meets with cases of St. Vitus' dance, and even of epilepsy or of persistent vertigo, which may be directly traced to the parasite; but such cases form but a very small fraction of the whole number.

Treatment.—The first indication is to avoid badly cooked beef, pork, ham or bacon. The second is to expel the parasite, a thing more easily said than done. A belief to the contrary is a common professional delusion. The best, perhaps, of all known systems of treatment is the following:—Empty the bowel at bedtime by means of castor oil or other satisfactory and thorough purgative. The next morning, before breakfast, and while yet in bed, one of the following two formulæ to be taken:—

1. Extract of male fern, 80 drops; syrup of ginger, ½ oz.; oil of cinnamon, 1 drop; mucilage of tragacanth, 2 oz.; water, up to 4 oz.—This dose may be repeated once a week for two or three weeks in succession.

2. Spirits of turpentine, ½ oz.; castor oil, ½ oz.; spirit of peppermint, 30 drops; mucilage of tragacanth, 2 oz.; water up to 4 oz.

This latter medicine may be taken without any previous administration of castor oil or other purgative. Turpentine is, however, an unsuitable medicine for childhood and infancy, and should never be administered to persons of less than fifteen years of age, except under medical supervision.

CONSTIPATION AND DIARRHŒA.

Before we finally leave the subject of derangements of the intestines, we must devote our attention to the two opposite conditions above mentioned, which, though merely to be ranked as symptoms, are yet a great source of trouble to many people, and demand, therefore, our careful consideration. First, let us take up the question of constipation. If my reader has carefully followed me through the description of the different processes that food undergoes in the human intestine, he will readily perceive in how many different ways it may be retarded in its onflow, or its normal consistence be interfered with. In the first place, it must be remembered that the contents of the bowel are *fluid*, except in the last few inches of their course. When the chyme leaves the stomach, it has generally the consistence of thin milk gruel. The smaller bowel absorbs, however, with the digested starches and albumens, a large amount of the water, and the larger bowel deprives it of more, until at last a firm substance only is left for ejection from the body.

Let us see in how many different ways constipation may be brought about. We will treat the subject under different headings.

First Cause.—The muscular power in the intestinal walls may be deficient. This failure is seen in old age and in conditions of general weakness, and, of course, in all cases of paralysis that affect the brain or spine. Again, by leading an inactive life, the powers of the diaphragm and of the abdominal muscles may not be brought efficiently to bear on the intestine.

Second Cause.—The fault may lie with the secretions of the intestine. Bile may be deficient, for the bile pigments and bile acids, by their softening powers on the chyme, not only maintain in it a certain amount of fluidity, in spite of the absorptive powers of the intestine, but they also stimulate the muscular fibres of the bowel, and keep these in proper action. But not only has bile this function, but the pancreatic fluid and the secretions of the small intestinal glands possess similar properties; and these fluids may be defective, checked in their action through the medium of the nervous system as a result of a general febrile state, or of some derangement of the stomach, or acted on directly by some article of a drying nature that has been consumed with the food, such as the tannin which occurs in tea, in port wine, and in the bark, stems and fruits of many plants. The chalk present, in some drinking waters, has a similar effect to tannin.

Third Cause.—There may be some obstruction in the bowel, such as the pressure exerted on certain portions of it by an enlarging womb, which is a common source of constipation in the pregnant state, or a tumour growing from some one of the abdominal organs may narrow its channel, or disease, such as cancer, may attack the intestine itself and gradually occlude it The commonest of all these impediments are, however, masses of partly digested or of indigestible food, which, as we shall see in treating of diarrhœa, the bowel will usually, by one of her perfect and beautiful processes, misnamed disease or derangement, succeed in displacing and expelling unaided.

Fourth Cause.—Constipation is often produced by improper food; but this condition is as a rule soon rectified by nature.

It is the consumption of food, if I may use the expression, of too *perfect* a kind which results in constipation. The body exacts that, with all food, a certain amount of indigestible material shall be consumed, such material acting as a *stimulant* to the intestinal wall. All seeds, for example, contain a large proportion of matter which is utterly unfit for human nutriment, and which is always expelled from the body; but when, by artificial means, we eliminate this, as we do in the preparation of fine white flour, we produce a food which tends to produce constipation, and thus we see that the husks and vegetable fibres of grain really subserve a most useful purpose by mildly irritating the bowel in their passage, and thus, by reflex action, keeping it up to its work.

Fifth Cause.—There may be some unnatural drain on the fluids of the body which compels the intestine to absorb more than it otherwise would of the watery constituents of the chyme. This is seen in diabetes, for example, where the amount of sugar in the blood causes the excretion of an enormous amount of water by the kidneys, rendering the whole intestinal tract from the mouth downwards dry, and greedy for moisture.

At different periods of life the bowels are evacuated with varying frequency: in infancy, from one to three or four times a day; in youth and middle life about once a day; in old age about once every second day. Again, for certain special reasons, the cause of which we cannot always discover, some individuals, in their periods of evacuation, differ widely from the general rule. I know of more than one case where any endeavour to ease the bowels more than once in four or five days is followed inevitably by derangement of the general health, which is otherwise good. Again, in some individuals, especially in large beer drinkers, there will be three or four evacuations per day, and while the habit of beer drinking continues, such frequency is to be regarded in the light of a decided benefit.

Treatment.—In the first place, I cannot regard constipation in the light of a derangement. Like all the other processes of nature, its tendency is to maintain the general moving equilibrium of the body in its contact with certain, in this case unnatural, surroundings, and under certain, in this case unusual, conditions, and is, therefore, always beneficial, except, of course, when it is the symptom of a real decay or degeneration, like that of cancer, or of wasting of the walls of the bowels; but I will endeavour to direct the reader as to how he may avoid the unnatural surroundings and conditions which lead to constipation; which, if he accomplish, the constipation will promptly and necessarily cease, and he will be better in health, not because he is rid of constipation, but simply because the causes that produce it are removed.

Treatment.—If the muscular wall of the bowel be at fault, food of a kind that will stimulate it to action is the first thing to be sought for: grain, oatmeal, wheatmeal, etc., must be consumed largely. The patient can effect this by simply changing from white to coarse brown bread, or by eating porridges. Fruit, by virtue of its undigestible seed coverings, skin and vegetable fibre, will also be useful. But if these fail, it will be necessary to have recourse to vegetable matter that contains exceptionable powers of exciting action in the bowel, and oleaginous articles (olive oil, etc.), may be added to the dietary. If such fail, then coffee, beer, acid wines, tamarind drinks, and especially cider, etc., may be had recourse to. Then various sugars and salts may be tried. In children, treacle or gingerbread will often prove efficient, or the daily consumption of a small piece of mannite sugar, and in adults, Hunyadi Janos, Pullna, Æsculap, or some other waters rich in salts, are useful.

If all fail, and from the first, in certain cases of old age, or of paralysis, or of exceptional and special need, we may have recourse to certain products of the vegetable kingdom, which possess even stronger powers of inciting muscular action. Aloes, nux vomica, senna, etc., are of this class. We then order some such compound as one of the following:—

1. Aloin, $\frac{1}{2}$ gr.; extract of nux vomica, $\frac{1}{4}$ gr.; powdered myrrh, $\frac{1}{2}$ gr.; soap, $\frac{1}{2}$ gr.

2. Extract of socotrine aloes, 1 gr.; extract of nux vomica, $\frac{1}{4}$ gr.; extract of henbane, $1\frac{1}{2}$ gr.

3. Extract of socotrine aloes, 1 gr.; mastich, $\frac{1}{2}$ gr.; cayenne, $\frac{1}{6}$ gr.; rectified spirit, just enough to make a pill mass.

4. Extract of nux vomica, ¼ gr.; powdered black pepper, 1 gr.; compound colocynth pill, 2½ grs.

One or two of such pills to be taken at dinner-time every day, for five or six days.

But suppose the diaphragm and the muscles of the abdomen are so little used as to retard the passage of chyme, and lead to constipation. In such cases drugs are of no use whatever. Exercise, or, failing that, systematic kneading or massage of the abdominal wall, or the use of electricity, to set those muscles in motion, must be had recourse to.

But the second cause, namely, a deficiency of bile and of the intestinal secretions, may be in operation. How shall we deal with this? A general attention to hygienic rules will in the majority of cases, put matters right; but in a small percentage of cases, artificial aid may be necessary. We can therefore have a temporary recourse to pills which increase the bile flow, or we may take ox-gall to act as a substitute for bile. If we consider that the intestinal glands alone are at fault, the stimulating properties in the undigestible matters in grain and fruit must be used, or, in exceptional cases, the patient may take certain drugs which apparently act specially on these glands: such are the following mineral salts:—

Phosphate of sodium or tasteless salt (½ to 1 oz.), sulphate of sodium or Glauber's salts (¼ to 1 oz.), sulphate of magnesium or Epsom salts (¼ to ½ oz.), or citrate of magnesium—usually sold in an effervescent combination.

Any of the above may be taken in a little plain, or, better still, to disguise the taste, in a little peppermint water; but where it is necessary to administer them regularly, it is best to do so in the form of one of the natural mineral waters.

If the third cause, obstruction of the bowels, be in operation, we shall be justified in a dependence largely on artificial stimulants to excretion. We may therefore select some one of the following formulæ:—

Tamar Indien lozenges (1 to 2 lozenges), confection of senna (½ to 2 teaspoonsful), compound liquorice powder (½ to 2 teaspoonsful), castor oil (1 to 4 teaspoonsful), confection of sulphur (½ to 2 teaspoonsful), compound rhubarb pills (1 to 3 pills), Gregory's powder (1 to 4 teaspoonsful), aperient fruit lozenge (½ to 2 lozenges), syrup of senna (1 to 4 teaspoonsful), manna (2 to 8 drachms). The smaller doses are those suitable for infancy ; the larger for persons of adult age.

The above drugs are, however, only to be used as long as the obstruction persists. After it has been overcome, the regulation of the bowels must be attempted by simpler and more natural means.

Now as regards the fourth cause, viz., improper food, I will merely give a general recommendation to avoid highly concentrated foods of all kinds. Remember that the so-called waste material consumed is almost as important as the digestible and assimilable portions of our food, and that without it, these latter will not be efficiently digested. Nature absolutely insists on a suitable admixture of the two. Our most indigestible articles of food are usually those which are most concentrated—eggs, cheese, sugar, lean meat, pure fats and oils, for example. If we were to make the effort to consume so much pure albumen, so much grape-sugar, so much cooked starch, so much water and so many salts per diem, and were to allow the maximum amount fixed by physiologists as necessary for the maintenance of health, we should in the course of a very short time find out, to our cost, what a very necessary part is played in our food by vegetable fibres, pips, colouring matters, etc., which we are apt to regard as useless or noxious material. Man in a state of nature doubtless depended for sustenance largely on the vegetable kingdom, and consumed its various fruits, seeds, etc., without subjecting them to any so-called purification.

When we have to encounter the fifth cause, and find that constipation is due to the derivative action of some disease, it is irrational and harmful to treat the constipation ; our efforts must be directed solely to the removal of the cause which produces it.

In large towns, like London, one is, however, constantly brought into contact with people who, if they would, have it not in their power to lead hygienic lives, or even to purchase the fruits and vegetables necessary for the maintainance of that general health which is a necessary concomitant of a regular evacuation of the bowels. With such I adopt some such plan as the following :—

Directions to patients.—1. Go to w.c. every morning after breakfast, and make an effort to empty the bowel. 2. Drink a couple of glasses of light table beer, or a few glasses of an acid white wine in water, or one or two pints or so of cider, or of tamarind or other fruit water every day. 3. Take coffee for breakfast, and, if fatigue is felt in the middle of the day, take then, more coffee, with sugar, but without milk, as a beverage. This coffee may be taken hot or cold, with or without the addition of water, and with or without lemon-peel. 4. Take as much active exercise as possible. 5. If of the male sex, a pipe or two of tobacco per day will assist the object in view. 6. Have a cold or tepid bath every morning, and knead the abdomen firmly with the ball of the thumb from right to left for ten minutes. 7. Eat as largely of fruits and vegetables, brown bread and porridges, as you can. 8. For the first three weeks, take before breakfast, every third morning two teaspoonsful of Carlsbad salts in a tumbler of warm water, or one-third of a tumbler of Hunyadi Janos water in double that amount of warm water, or make an imitation mineral water as follows :—

Glauber's salt, 2 oz. ; common salt, ½ teaspoonful ; hot water, to 1 pint. The dose and method of taking it to be the same as that for Hunyadi water.

In place of the above, an injection of from one pint to two pints of cold or tepid water may be used every morning. If such a system fail, it is better to suffer from constipation than to resort to the habitual use of strong purgatives.

THE ACTION OF PURGATIVES.

Purgatives act by stimulating the intestine to a greater extent than food alone would do. But as all portions of the body after a time fail to respond to any stimulus less than that to which they are accustomed, it follows that if we rely on purgatives for constipation, we shall rarely, if ever, get the bowels again to respond to the natural stimulation of ordinary food, and, more than that, the unnatural stimulus will exhaust the vital energy in the bowel, and cause premature degeneration of its structure. As I have already stated, there is no margin in any organ by the help of which, without ultimate premature failure, it can stand overwork. An early and persistent stimulation of the liver leads to its early exhaustion, as seen in gout; overwork of the nervous system leads to its premature decay; and so on of the sexual and every other function of the human body. The action of this law being kept in mind, constant unnatural stimulation of the bowel by means of purgatives will be shunned. I have never yet met anyone who, without altering his dietary, or in some other way adopting a changed mode of life, has said that he was *cured* of obstinate constipation by any purgative. Temporary relief at the cost of future trouble may have been attained, but not cure.

DIARRHŒA.

The causation of diarrhœa is over-stimulation of the muscular walls of the intestine and of the abdomen, or over-excitation of the liver and intestinal glands. Like constipation, its action, unless it be due to actual decay of the bowel wall, as seen in waxy degeneration, is beneficial, and if the irritant which produces it be in the bowel, the tendency of the increased muscular contraction and of the intestinal secretion is towards its removal. This beneficial action is particularly remarkable in that form of diarrhœa which sets in as a result of prolonged constipation. When the collection of waste material in the bowel has reached such a size that it begins to distend the bowel, or has undergone a change the result of which is the formation of an acid, or a gas, that acts as a stimulus to the bowel, the walls of the latter commence by reflex action to contract strongly, and the intestinal glands to secrete a larger amount than usual of their special product, and the result is diarrhœa, ending only when the cause which set it in motion—namely, the collection of fæcal matter—is removed.

Before finally quitting the subject of primary dyspepsia, let us, to keep the processes fresh in our memory, take a short tabular view of them.

There are four classes of foods—albumen, starch (sugar), fats and salts.

The albumen is acted on by the ferment pepsin (*i.e.*, pepto-hydrochloric acid) in the stomach, and by the ferment trypsin of the pancreas. It is absorbed by the walls of the stomach and bowel and goes to the *portal vein*, which carries it to the liver, to undergo secondary digestion there.

The starch (the sugar) is acted on by the ferment ptyalin (diastase) in the saliva of the mouth, and by the ferment amylopsin (diastase) in the pancreatic fluid, which change it to grape sugar, which is absorbed by the walls of the stomach and bowels and goes to the *portal vein*, which carries it to the liver, to undergo secondary digestion there.

The salts require no digestion, but are absorbed directly into the *portal vein*, which carries them also to the liver.

The fats are emulsified by the bile and pancreatic juice. This emulsion goes to the *thoracic duct*, and straight into the general blood circulation. Fats are also digested by means of a ferment called steapsin, which splits them up into glycerine and fatty acids. These latter also, like the emulsified fats, go to the *thoracic duct* and straight into the general blood circulation.

Fats, therefore, form in one important respect, an exception to all other articles of food, inasmuch as they do not go to the liver.

CHAPTER XII.

SECONDARY INDIGESTION.—DISORDERS OF LIVER.

WE have, therefore, in the portal vein, travelling direct to the liver—(soluble) grape sugar; (soluble) albumen; (soluble) salts.

The liver is composed of a number of lobules bound together by connective tissue. These lobules are all precisely alike in structure and function; and, therefore, in studying what goes on in each lobule, we shall be reviewing the whole of secondary digestion. The portal vein, directly it reaches the liver, splits up at once into as many minute branches as there are lobules, and each lobule receives a branch, and therefore an exactly equal share of the blood that was in the portal vein. But each of these small lobular portal veins divides again in each lobule into smaller veins which ramify amongst the cells of which the lobule is composed.

In describing the processes of primary digestion, I showed how the insoluble starch and albumen of our food were, by means of ferments, converted into soluble grape sugar and soluble albumen, and then could pass through the thin single walls of the small blood-vessels in the stomach and intestine, and were thence conducted into larger and larger tributaries of the portal vein, till they at last reached that great vein itself, and were swept on to the liver. These larger tributaries and the portal vein have several coats, and therefore the sugar and albumen cannot escape out of them; but as the vein splits up in the liver, its subdivisions again become thinner and thinner, until at last those minute branchlets which circulate amongst the liver cells have, like those in the walls of the stomach and bowel, but one single coat or layer of cells as a covering. This suffices to keep the red blood-cells and most other solid bodies in bounds,* but the soluble grape sugar and soluble albumen (which latter is called peptone) pass out, escape, and are seized on and absorbed by the liver cells. With the sugar and albumen escape also the soluble salts which have been consumed with the food. Now, what do the cells of the liver do with these three substances? They promptly deprive the sugar and albumen of the molecule of water which they received in the stomach and intestine from the ferments ptyalin, amylopsin, pepsin, and trypsin, and render them again insoluble. This arrests at once their onward passage, and permits of their being stored up in the cells, to undergo the processes of secondary digestion. As for the salts, these, as we know, never underwent any primary digestion; they were always soluble, and remain so; they therefore pass on through the cells, a small amount of them being, however, detached in transit, and sent off to assist in forming bile; the larger amount reaching the hepatic vein which is placed in the centre of each lobule, and joining the general blood current to the heart.

What do the liver cells do with the now insoluble sugar and albumen, which they have so carefully arrested and stored? They, *slowly and gradually*, reconvert the insoluble sugar (glycogen) into soluble grape sugar, and serve it out to the body for combustion. They also, *slowly and gradually*, reconvert the insoluble albumen once more into soluble albumen, now called serum albumen, and serve it methodically out to the body, to maintain and repair its cells. Both this and the soluble sugar leave the liver, as did the salts, by the hepatic vein, and go straight to the heart, and thus to all the body. Much of the insoluble albumen, all in excess of the needs of the body cells, they split up into bile acids and urea. But for these powers which the liver cells possess of arresting the sugar and albumen brought to them by the portal vein, we should after each meal have suddenly a huge quantity of sugar and albumen thrown on the circulation, and the excess, over and above our immediate necessities for combustion and tissue repair, would travel rapidly out of our bodies by the kidneys, setting up a great deal of disturbance on the way; and thus within a very short time after each meal we should be as hungry as we were before,—in fact, life would be but one long meal, a state of matters which, as we shall see, actually occurs when the storing function of the liver is deranged, as it is always in diabetes.

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* Not altogether; for some red blood-cells escape, and are destroyed by the liver cells, their colouring matter being used to form the pigments of bile and urine.

But supposing that the liver cells lose this power of arresting and storing grape sugar, and allow it to pass unchanged by them—what results? *Diabetes:* And if the cells allow the soluble albumen (peptone) to slip past them? *Albuminuria.* But if the cells can perform the first part of their duty as regards the albumen, namely, can convert some of it into proper serum albumen, but fail in the second part, namely, that which has to do with the formation of bile and urea? then, if the formation of bile be defective, such a failure leads to *Biliousness*; if the formation of urea be defective, it leads to *Gout.*

But the reader may say, "Surely I have read that gout and diabetes are due to disease of the nervous system, and that albuminuria has to do with the kidneys?" Now, all disease of the human body, except that which, like fever poison, enters from without, may have two origins, either in the deranged organ itself, or in the nerves which rule and regulate it. I have spoken of acute inflammatory dyspepsia as it affects the stomach, as due generally to excessive drinking; but the same disease can be produced by cutting or paralysing certain so-called vaso-motor nerves which go to that organ. Atony of the stomach may be, and often is, produced by paralysis of certain nerves, as well as by deficient power in the organ itself. So it is with gout and diabetes—both, as we shall see later on, may begin in the liver or in the nervous system, but wherever they begin, the result is the same, *i.e.*, *failure of storage power on the part of the liver cells*, and the sequences directly due to such failure. Albuminuria may be due either to liver or kidney failure. That form which is due to liver failure pure and simple, is called hemi-albuminuria, or peptonuria, and is distinguished from the other, which is due to kidney disease, and which is of far greater importance, and is in fact real serum albuminuria by the different effects that heat and certain acids have on the albumen contained in the urine. In dealing with the failures of secondary indigestion, we are therefore brought face to face with diabetes, gout, a form of albuminuria, and biliousness.

DIABETES.

The liver has two blood supplies, namely, that brought to it by the portal vein, which runs off again by the hepatic vein, and that brought to it by the hepatic artery, which also runs off by way of the hepatic vein. The function of the portal vein is to bring to the liver cells material on which to work. One of the main functions of the hepatic artery is, to nourish each cell, and to supply each cell with a ferment (diastase), present in all arterial blood, by which it can slowly convert its store of glycogen into soluble grape sugar, but, to some extent, the blood in the hepatic artery assists in the formation of bile, and of urea also.

Now, every cause that leads to extra pressure in the hepatic artery will lead to an extra supply of diastase to each cell, and a more rapid output of grape sugar to the system at large. This state of matters we see in some forms of Bright's disease, and of heart disease, when the pressure in all the arteries of the body is raised; and both those complaints, therefore, produce diabetes, though of a mild and sometimes remediable kind. Every cause whatever that leads to a block in the hepatic vein will also lead to the retention of too much hepatic blood, and therefore to the presence of too much of this ferment (diastase) in the liver, and therefore equally to diabetes. This arrest of the outflow by the hepatic vein may be due to the pressure on it of a tumour, or to a failing and gorged heart, dependent sometimes on disease of the heart itself, sometimes on some obstructive disease in the lungs; and both will, as experience tells us, lead to a mild form of diabetes; but the commonest cause of diabetes is paralysis of the (vaso-motor) nerves, which maintain a proper state of contraction in the hepatic veins. This leads to diabetes, of the intractable and fatal form. Thus, diabetes is due either to too great pressure in the hepatic artery or to a retarded outflow by the hepatic vein: both conditions leading equally to the presence of an excessive amount of diastase in the nerve cells, and to a rapid conversion by it of the stored glycogen into grape sugar, thus to incessant hunger and all the other symptoms of that terrible complaint.

Thus diabetes may be, as is often seen in elderly people, whose hearts or kidneys are functionally inactive, not a very terrible disease, or it may be due to brain disease, and prove fatal with very great rapidity. The outlook for the patient depends, in each case, on the primary seat of the malady.

The symptoms of Diabetes are always alike in kind, but vary in intensity with the amount of the diabetes present.

In the worst form, that in which brain disease is the cause, *no* glycogen can be stored. As fast as it is formed it is reconverted into grape sugar, and we therefore find the following symptoms present :—

Great and incessant hunger.—This arises from the inability of the liver cells to retain sugar. The supply brought by each meal is soon exhausted, the starving body calls for more, and the patient experiences hunger. This is the only symptom *directly* due to the diabetic state, all the others depending on the presence of an excess of sugar in the blood. This excess excites the kidneys to constant action. They carry off the grape sugar, but with it they take away the large amount of water necessary to keep it in solution, and in this way 10 to 50 pints of urine are passed per diem. This loss of fluid naturally gives rise to an *incessant thirst*, to *dryness of the mouth and skin*, and to *constipation*. But the excessive amount of sugar in the blood interferes also with the nutrition of the cells of the body, and this again leads to *great weakness*, *malaise*, *failure of heart*, *consumption*, *cataract*, etc. All the reserve fat stored by the body is gradually used up, and the patient becomes thin and wan.

In mild cases, where the liver cells still retain some power of storing glycogen, all these symptoms will be proportionately modified. I often meet with diabetes in the elderly or in the subjects of chronic asthma or bronchitis, who make very little complaint, in whom, in fact, the disorder has been only accidentally discovered on analysing the urine. One caution I must here give to my readers. Grape sugar is often, after a full meal, present in the urine of perfectly healthy people, especially if they have partaken of much sugar with their food; in fact, by eating an excess of sugar, almost anyone may produce a temporary glycosuria, for such is the name that this physiological appearance of grape sugar (glucose) in the urine has received.

Treatment.—If the cause be simply great arterial tension, we must seek, by aconite, etc., to moderate it. If some lung affection be causing a chronic state of engorgement of the right side of the heart, and through it of all the veins of the body, we had best turn our attention solely to the lung. If nerve or brain disease be at work, the patient must take complete rest, place himself in skilled hands, and steadily pursue the course recommended to him. The disease must then be combated by drugs and diet.

Drugs.—Codeina, an alkaloid derived from opium, tends to produce, through its action on the vagus, a state of contraction in the small hepatic blood vessels in the liver, and thus to counteract their paralysed and dilated state. Unfortunately, this effect of codeina is soon lost, and in order to maintain its beneficial action at all, the dose has to be systematically increased from one half to five or more grains, thrice daily. I subjoin formulæ :—

Codeina, $\frac{1}{2}$ gr. to 5 gr.—the larger dose only advisable when it has been gradually approached by means of smaller ones; extract of nux vomica, $\frac{1}{4}$ gr.; extract of lettuce, 3 gr. This pill to be taken thrice daily.

Or codeina lozenges, commencing with four, which may gradually be increased up to thirty or more, three times a day.

Codeina, it may be remarked is, like all the derivatives of opium, a drug to be taken with the utmost precaution.

Lactic acid.—Much was at one time hoped from this drug in the treatment of diabetes. It was known that in health, after grape sugar left the liver and entered the circulation, it became, in large part, converted into lactic acid in the system, and it was therefore reasonable to suppose that if this acid were administered, it would in the tissues act as a substitute for the grape sugar, for everything that can make grape sugar has, as we shall see when we come to consider the dietetic treatment of this disease, to be omitted from the invalid's food. But the dose of lactic acid administered was, in order to be efficient, perforce so large

—from 150 to 300 grains per diem,—that it was soon found that no stomach nor intestine could for long tolerate it. Buttermilk, and koumiss, both rich in this acid, were then substituted; and treatment, depending largely or entirely on the administration of these fluids, has even at the present day many firm adherents.

Many other drugs, besides the two quoted, have been and are being tried. Salicylates, iron, strychnia, phosphorus, rennet, yeast, etc., being amongst the number. My experience of them has been that they are useless; any little temporary benefit which may accrue from their administration being more than counterbalanced by the evils which accompany their employment.

Dietetic treatment.—The *rationale* of this consists in an avoidance of everything, such as starch, cane sugar, beet sugar, etc., that can be converted into grape sugar by the mouth and intestine. In other words, as we have to deal with a complete breakdown of the glycogen-forming function of the liver, we seek to maintain life on the fats and albumens alone.

The diabetic *may eat* butcher's meat of all kinds, ham, bacon, or other smoked or cured meats. Poultry, game, and fish of all kinds, fresh, salted, or cured. Animal soups not thickened, beef tea, and broths. Almond, bran or gluten biscuits, or bread of the same materials. Eggs, cheese, cream cheese, butter, cream. Greens—spinach, turnip tops, French beans, Brussels sprouts, cauliflower, broccoli, cabbage, asparagus, seakale, vegetable marrow, mushrooms. Water-cress, mustard and cress, cucumber, lettuce, radishes, celery, vinegar, oil, pickles. Jelly, sweetened by saccharine, savoury jelly, blancmange made with cream, but not with milk, custards made without sugar. Nuts of every description, except chestnuts. Olives.

He may drink—tea, coffee, cocoa made from nibs. Dry sherry, claret, Sauterne, Burgundy, Chablis, Hock, brandy, and spirits that have not been sweetened by sugar, soda water. Burton bitter ale in moderate quantity.

He must *not* eat—sugar in any form, wheat bread nor biscuits. Rice, arrowroot, sago, tapioca, maccaroni, vermicelli, potatoes, carrots, parsnips, beetroot, peas, spanish onions, liver, nor shell fish, pastry nor puddings, nor fruits of any kind, fresh or dried.

He must not drink—milk, except sparingly, sweet ales, porter nor stout, cider, sweet wines, sparkling wines, Port wine unless sparingly. Liqueurs.

In addition to the above, Messrs. Van Abbott, Blatchley, and other makers of specialities for diabetics, are manufacturing many palatable foods, free from starch or sugar—so that a large variety may be secured; but I must gravely caution the diabetic to obtain them from such approved houses, for recent researches by Dr. Pavy have shewn that many of the so-called gluten breads and biscuits, maccaroni, etc., for diabetics, contain from 70 to 85 per cent. of starch! The restricted dietary of a diabetic contains abundance of all that is necessary for the nourishment of the body, and a strict observance of it will free him almost at once from most of those secondary inconveniences which flow from the constant presence in the blood of an excess of grape sugar. The symptoms will be alleviated, but the disease will, if it be of nervous origin, persist, and almost inevitably end fatally. If other causes have produced it, there is, however, hope of complete recovery, if those causes can be removed or their effect moderated. In every case, before the patient allows himself to be alarmed, let him be sure that he has real diabetes, which is a rare disease, and not simple glycosuria, resulting from some slight temporary derangement of health—from gout for example, or from the consumption of an excess of articles of food rich in sugar and starch.

HEMI-ALBUMINURIA OR PEPTONURIA.

This bears the same relation to Bright's diseases of the kidneys that glycosuria does to diabetes, and is, *in itself*, not a symptom of very grave import. Dr. Lauder Brunton says, in his book on Dyspepsia, that a medical experimentalist produced in himself, very rapidly, albuminuria, by consuming six raw eggs in succession. That gentleman's liver was probably in good order, and it is quite conceivable that in an individual, say of the gouty or bilious type, whose secondary digestion is never very perfect, even a couple of eggs might suffice to produce a similar state of matters; and this is, indeed, what we often find in actual practice.

While, however, the albuminuric, like the glycosuric and the bilious individual, may justly congratulate himself that he is not suffering from a dangerous disease, he will do well not to treat his derangement too lightly, lest from a more and more frequent recurrence, it pass, like gout, into a chronic and incurable disease. Drugs he need not take, but he will do well to cut down the amount of daily animal food to as low an ebb as possible. A full amount of fats and starches may, however, be allowed to him. Alcohol should be interdicted. All hygienic rules should, as far as possible, be observed.

We now pass on to the third great derangement of secondary digestion—

GOUT.

If my reader has comprehended my description of secondary indigestion, given at the commencement of this chapter, it will be very easy for him now to trace the cause of this disease. The surplus albumen, that which is not needed to form serum albumen for the blood, is, in health, as we know, broken up by the liver into bile acids and urea.* If the liver be strong, its nerve supply in good order, and the amount of albumen sent to it not greatly and constantly in excess of the normal, the above is what takes place. The bile goes, as we know, to the intestine, and the urea travels out of the body by way of the kidney. But suppose that the liver be weak, either from a congenital or an acquired lack of tone, or that it constantly receive a surfeit of albumen, or that its nerve supply be inefficient, or suppose, as is frequently the case, that more than one of the above conditions be simultaneously present, and what will be the result? The liver will not be able to complete the above process, and instead of bile acids and urea, we shall have bile acids (probably of an inferior kind), urea *and uric acid.*

Now, uric acid may be regarded as urea in an arrested state of development. It is, in health, always present in human urine in the proportion to urea of 1 to 45, the total amount of uric acid, per diem, in an adult, being from 7 to 10 grains. This, however, in health, does not come from the liver, but from the tissues of the body, according to some authorities, or is prepared by the cells of the kidney, according to others.

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* Probably the albumen derived from old and defective red blood-cells which the liver breaks up, and whose pigment it uses for the bile and urine, is also dealt with in the same way.

But to return to our defective liver, which is throwing urea, *plus* uric acid, into the blood current. Urea dissolves very readily in water, and, therefore, is easily carried out of the body by the kidneys; but uric acid is very insoluble, and, furthermore, directly it reaches the blood current, it, being an acid, unites with the alkaline bases it finds there (sodium, potassium, calcium, &c.), and forms urates of sodium, etc. Sodium is the main alkali in the blood, therefore urate of sodium is practically the enemy with which we have to deal. Now, urate of sodium is also, like uric acid, very insoluble, and requires, according to temperature, from twelve to fifteen thousand times its own weight of water to dissolve it; whereas urea is soluble in its own weight. By reason of its insolubility, even a small amount of urate of sodium becomes, it may be readily understood, difficult to deal with. If the amount be very minute, and the kidneys functionally active and strong, the urate is expelled from the body forming the deep brick-red deposit,* sometimes so plentiful as to form real sand, which many of us may have seen, and which so frequently occurs in the urine of gouty subjects. But if the urate of sodium be present in large quantities, or if the kidneys be so feeble as not to be able to get rid of the smaller amounts, and allow it to accumulate in the blood, what will happen? Very speedily the amount will become so large that the fluids in the blood and in the tissues, through which it, like all other fluids in the blood, passes, can no longer keep it dissolved, and some of it will crystallize in the tissues; and we shall have, as a result of the irritation of its sharp crystals, pain and inflammation in the part—in other words we shall have, what is called *gout.*

So far the sequence of matters is clear enough; but why, it may be asked, should gout particularly select the joints and the old scars of wounds for its attack? Because the connective tissue of which scars are largely composed, and the neighbourhood of the cartilages of joints, are the least supplied with blood of all the structures of the body, and the urate of sodium leaving the small blood-vessels with the salts and serum albumen of the blood, takes with these (for it is itself a salt) its due course through the lymph channels, and being even less soluble in lymph than in blood, and having in parts where blood-vessels are fewest relatively more lymph spaces and lymphatic ducts to traverse, it is naturally arrested first of all in these situations.* Of all joints in civilised boot-wearing man, it selects by preference that of the great toe, presumably because that joint has, by pressure, been deprived more than any other of its small supply of blood for its cartilages. When the urate of sodium is constantly deposited, it forms at last white hard masses which are called chalk stones. These may be seen, as small knobs, on the joints of the hands and in the lobes of the ears of gouty persons. They also occur in the valves of the heart, in the kidney, and other situations. In the bladder they form one of the commonest kinds of "stone."

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* The urates that are present in the urine are not always, though most commonly, red in colour.

Let us pause and review the situation :—

Dealing with the surplus albumen of the food, the liver should convert it into bile acids and urea; but if a man inherit a weak liver, or if his general body health become low and thus weaken that organ, or, if he constantly consume an excessive amount of albumen (meat, fish, peas, beans, &c., contain albumen in the largest proportion), or if, through worry or anxiety, or owing to venereal or other excesses, he injure his nervous system, and with it weaken the nervous supply to the liver,—if any one of such causes or any combination of them be in action, bile acids, urea, *and* uric acid will be formed; *i.e.*, the urea will be lessened and the deficiency made up by uric acid—and the uric acid, when it reaches the blood, will form urate of sodium at once. Urate of sodium, directly it attains a certain percentage of the blood, will, as it is very insoluble, become, in its passage through the lymph channels, deposited as crystals, which will cause the inflammation known as gout. This inflammation will usually manifest itself first in the joints, for in the cartilages that appertain to them the lymph channels hold to the blood channels a higher proportion of length than in any other part of the body, and urate of sodium is even less soluble, and therefore more apt to crystallize out, in lymph than in blood fluid.

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* In gout, a small quantity of free uric acid is found in the blood, in addition to the urate of sodium.

This leads us up to our first attack of gout.—How do we get rid of these crystals?—how is it possible that there can be any relief to such a condition? Let not the sufferer alarm himself. Nature's symptoms are always beneficial. The pain and inflammation check or arrest the invalid's appetite, and with it the supply of albumen to the liver. The extra heat produced by the inflammation in the joint leads to an increased flow of blood to that part, which again leads to increased oxidation, and the urate of sodium crystals, by this process of oxidation, are converted to urea and sodium, which flow freely away in the blood current. So the attack passes away, even without any medicinal treatment whatever, and the individual is once more well. If he reform, and will simply regulate his food by the power possessed by his liver,—if he will strengthen that organ by improving the general tone of his body by exercise and by the observance of well-known hygienic rules, all will be well with him. But if, unwarned, he pursue his old course of life, the liver will, with a greater and greater frequency, break down, and, worse still, the kidneys, constantly stimulated by the irritation of urates in the blood, will become exhausted and begin to degenerate and fail, incurable gouty Bright's disease will set in, and urate of sodium, and even urea itself, will at last be unable to find exit by their accustomed channels, and the patient will die poisoned by his own products.

Gout does not, however, by any means, always manifest itself first of all, or even at all, in the joints. Much of the so-called chronic rheumatism one meets with is in reality gout—the result of the depressing action on the liver of a general failure of strength.

"Ah, doctor, I should be so thankful if you could cure my gout." Such is the remark one frequently hears from the lips of a valetudinarian whose attacks of gout have been many, and whose liver and kidneys are long past praying for—are, in fact, degenerating, in other words, partly *dead.* It is, of course, simply impossible to restore them. One can point out to such a sufferer that he may economise the spare strength still left in those organs, and thus prolong his life and render it more tolerable; but that reconstruction, which is what is really implied by his modest request, would require, on our part, the gift of a creative faculty. Let the reader understand that nature is utterly remorseless. She gives each individual his heritage at the commencement of the race of life, and to it she can make *no addition* whatever. Every action, of whatever kind, even the disposal and consumption by his tissues of nutriment, even the beneficial processes by which equilibrium, when lost, is usually (nearly) restored, are carried out at *the individual's own expense.* He can avail himself, it is true, of the energies of surrounding objects, but that again involves an expenditure of his own capital, and, with the exhaustion of that comes death; in other words, that great and most perplexing chemical compound, the protoplasm of the ovum, has for five, ten, twenty, forty, eighty years, whatever the term of life has been, as the result of the action on it of external agencies, been undergoing myriads and myriads of simplifications, evolving and parting with its stored chemical energy with each and every change of formula, till, at last, the problem is closed and the organic crosses the boundary and becomes the inorganic; and with that last step the manifold phenomena called, in the aggregate, life, that with each simplification have become less and less characteristic of organic, and have been approaching more and more closely the simpler inorganic actions of inert matter become entirely of the latter class, and the proud human body is again on a level with the dust from which it actually took its rise.

Mercy is purely a divine attribute, and supernatural in every sense of the word. It applies to moral but not to physical sins, and the penance exacted by nature for these latter, not only applies to the offender, but, if he fail to purge his contempt of nature's law, to adopt legal phraseology, his children will have to make up the deficiencies, and if they fail and allow too great a load to accumulate, extinction of the family and race will result. It is never too late to mend may be written on the soul of man, but it is ever too late to mend, is written everywhere on his body. Let not my reader regard me in the light of a fatalist, or, worse still, of a strict materialist. The physician's place is to deal solely with the physical structure of man, and with the discovery and explanation of the properties which appertain to it, and he may, none the less religious, none the less anxious for the welfare of humanity, if he refuse to join in the general cry of Peace, peace, when there is no peace. His duty is very similar to that of a pilot; he has to find the safe and deep channels, and to advise on the presence of shoal and rocks, especially of those whose main danger lies in the fact that they are covered by a deceptive layer of calm but shallow water. The human body has been aptly compared by many musical writers to a ship.

"Yet her pilot is thinking of danger to shun,
  Of breakers that whiten and roar,—
How little he cares, if in shadow or sun,
  They see him, who sit by the shore,
He looks to the beacon that looms from the reef,
  To the rock that is under his lee,
As she drifts on the blast, like a wind-wafted leaf
  O'er the gulfs of the desolate sea."
—OLIVER WENDELL HOLMES.

But what has all this to do with gout? Much, very much. There is no disease which so completely represents nature in the light of Nemesis as that complaint, nor is there, perhaps, any other in which people allow themselves to drift along so nonchalantly, and even so proudly.

I will now give a few of the commoner symptoms indicative of the presence of gout—will recapitulate its causes, and will then devote a few pages to the very important subject of its dietetic and medicinal treatment.

Symptoms.—One of the greatest drawbacks of gout is the multiplicity of the symptoms, and the difficulty of always weighing their real significance. Perhaps the reader may have pictured to himself this disease as a mere joint affection. In that case, he has been mistaking one symptom for the many hundreds which the term gout comprises. When urate of sodium exists in the blood in excess of the eliminating powers of the kidney, it will, as a rule, go to that portion of the body which, by inheritance, or as a result of misuse, is the weakest part of the individual. In one fairly sound it will, no doubt, select the joints, but if there be any other part of the body where, as a result of derangement, there is an even more limited supply of healthy blood than in the cartilages of the joints, it will pick them out; and most individuals have in some part of their mechanism such weak points that attract gout, and divert it from the joints, as the lightning rod does the electricity from the building. Therefore, in one man gout manifests itself by nervous tremors, in another by sleeplessness, by asthma, by depression of spirits, by hypochondriasis, by vertigo, by neuralgia, or even by epilepsy. In one the nervous system is the vulnerable part in the heel of Achilles. In another, constant acidity of the stomach and intestines, with the development of flatus and troublesome fermentations in those regions are the only complaints. In yet another, bronchitis and bronchitic asthma. In another, irregular action and loss of rhythm in the heart, and so on. Gout, like Proteus, is ever assuming different shapes. Of course, frequently there are combinations of symptoms—gouty bronchitis, with gouty dyspepsia, or with indifferent heart's action. Gouty asthma will co-exist with gouty lumbago, or with stone in the bladder. But in each and every case the disease is but single, and, if carefully looked for, is certain pretty soon to show itself, if only for a few hours, in an unmistakable form; and, once certain of its presence, it is not often difficult to combat, with good hopes of success. Once suspect the presence of gout, and a careful analysis of the urine, or, better still, of a little blood serum obtained from a blister, will set all doubts on the point at rest. I do not intend here to describe the steps by which the analysis is made, as it might lead to experimentation on the part of the reader, and, in all probability, to his mistaking some other chemical constituent of the two fluids which I have mentioned for gout poison. Besides which, too close an inspection of one's own bodily structures is apt to beget, even in the minds of medical men, a species of hypochondriasis, which, when once developed, becomes a great source of misery to its possessor.

The causes of gout I have already more than once referred to. Hereditary weakness of the liver; gluttony—especially an excessive consumption of animal foods, combined with certain forms of alcohol, and with other articles of diet, which, though in themselves proper enough, help, in combination with the two last, to overtax and prematurely wear out the liver; worry, overwork, anxiety, or any depressing influence which acts on the body at large, want of proper nourishment, which, like overwork, leads to liver failure, etc., etc. But I hear my reader exclaim, "What about the commonest causes of all — damp and exposure?" In reply, I would say that, in the non-gouty, such influences no more lead to gout, or to rheumatism in the non-rheumatic, than do the stars in the firmament. When a man, as a result of the action of any of the causes I have mentioned, has saturated his fluids with gout or rheumatic poison; when, with his skin and kidneys working at their very best, he is just able to keep down the urate of sodium from gaining the ascendancy sufficiently to crystallize out, *then, and then only*, does ordinary exposure to cold and damp affect him, just as the last straw may break a camel's back. Check the action of his skin and kidneys ever so little by those agencies, and we have gout or rheumatism at once developed, but not produced by them. There are tens of thousands of men swathed in flannel, passing the day in air kept by artificial means dry and warm, and sleeping at night in comfortable beds, who, by those means, are just able to escape the above diseases; but let such men engage in a campaign, pass one or two days in fear and anxiety, and one or two nights in the open, and the enemy lurking for months in their bodies will be upon them, and he in all campaigns claims more victims than the lead and steel of opposing armies.

HYGIENIC AND DIETETIC TREATMENT OF CHRONIC GOUT AND OF THE GOUTY STATE IN GENERAL.

Foods.—Albuminous foods are to be eaten sparingly. That is the first and most important point. Such are, to a very large extent, all animal foods, for they are, so to speak, mere masses of dead protoplasm; and protoplasm, as we know, is a form of albumen, with a certain admixture of stored up fat (hydrocarbon). All seeds contain albumen, some in larger proportion than others, such are the pea and bean tribes. Now, vegetable albumens differ in many ways from the animal forms bearing that name, and I maintain are much more easy of digestion. The physiologist and scientist will call on me for some proof of my statement, and I confess that I am at a loss to furnish convincing facts, but I appeal to experience, which amply bears me out; for numbers of dyspeptics who cannot manage the digestion in comfort of even the flesh of the most delicate of white fish, will consume without the least ill effect a dish of lentils, of porridge made from oats or from any other form of cereal, which may contain double the relative weight of albumen. This is one of the great secrets of the success of such foods as Du Barry's, Russian food, Egyptian food, etc., all of which contain lentils as a main ingredient; and lentils, be it remembered, contain a much higher percentage of albumen even than beef itself. No doubt the disintegration of the fibres of meat, a necessary preliminary to its digestion, has something to do with the difference observed in the way in which the stomach behaves in the presence of vegetable, as contrasted with animal albumens; but even this cannot be the sole cause, for shred the meat as finely as we may, or select that form of it which consists of the softest and shortest fibres, such as are present in sole or plaice, and we still observe a notable difference. Nor is it anything but natural that such should exist, for vegetable protoplasm in its powers has a very different range to its animal counterpart, and its structure is, doubtless, proportionally different.

In advanced and very troublesome gout, I therefore very strongly recommend a strictly vegetable regimen. I am thoroughly convinced of its utility in all forms of the disease which have arisen in any way from the excessive consumption of animal foods by the sufferer or by his ancestors. When, of course, one finds gout in a weak, half-starved individual, the treatment is very different, and meat may be allowed, even recommended, at two or three meals a day. If the gouty sufferer be unwilling, as he often is, to adopt a purely vegetarian dietary, or if the case be a mild one, it is well to indicate what forms of animal food are the most suitable. Amongst these, fish stand first and foremost. The white-fleshed and the softer varieties are, of course, the most easy of digestion, but, practically, all sorts of fish are superior to all varieties of food derived from that part of the animal kingdom which live on land. Next to fish come poultry and game. Then well-hung mutton, then bacon, then beef, then the flesh of young animals—veal and lamb for example, and last of all, ham, pork, salted and pickled meats. If very fat, meat is best eaten boiled; if lean, it should be roasted. Twice-cooked and fried meats are to be shunned.

Now a word in reference to the dietetic treatment, almost exclusively consisting of meat, recommended in gout by some lights of Medicine. That form of dietary, again, may, in some cases, prove satisfactory; nor is it really much at variance with other forms which exclude meat. If meat that is lean be taken at a meal with very little starchy food, such as dry bread, it agrees well as a rule, and for this simple reason, that nearly the whole power of the liver is available for the digestion of the meat albumens. But if after the meat a milk-pudding be consumed, the meat will most seriously disagree, for the glycogen-forming function of the liver will then be requisitioned, and the remaining power left in the liver to deal with meat albumens will be inefficient. Therefore a dietary that consists of regulated meals, some of which contain scarcely anything more than starch and fat ingredients, whilst others consist of albumens almost exclusively, is sometimes very successful; simply because the liver is never at one and the same time called on to exercise two very different functions. In such a dietary, fruits and green vegetables may be permitted a prominent part.

Beverages.—Malt liquors disagree, as do all sweet wines. Claret, Burgundy and Australian wines corresponding to those two classes, and port wine that has been long in wood, and which by the ordinary Englishman would be discarded as but a spectral variety of his favourite wine, may be taken, but even to these it is well to add a large quantity of water, plain or effervescent. Whisky and gin are the best spirits. Lager beer may be often consumed without fear of evil consequences. Water is, however, far superior as a beverage to all fluids containing any alcohol, and it may be, indeed often should be, consumed in large quantities. Tea, coffee and cocoatina agree generally very well.

Whichever dietary be selected, the amount of food consumed should be small. The gouty man must eat to satiety of nothing. Three meals a day are usually quite sufficient for him, and he should rise from each in a fit state to transact headwork or walk half-a-dozen miles with ease, should this exertion, which I do not, by the bye, recommend at such times, be demanded of him.

Fats disagree with the gouty. This is very easy of explanation. Bile acids and urea are made together, and if the liver fail in its *manufacture* of the latter, it is scarcely likely to reach perfection with the former. Thus we find that in gouty persons there is almost always a defective formation of bile. Now, the main functions of bile are, as we know, the emulsification of fat, and the disinfection of that and of the other foods in the intestine. The fats consumed are therefore not only not digested, but are allowed to ferment; for disinfection implies, in the case of bile and of most other such substances, the power of preventing fermentation. Cane sugar also disagrees, for it very readily undergoes lactic acid fermentation, and though, no doubt, most of it is changed to grape sugar, and absorbed before the outlet of the stomach is passed, much escapes the process. But the above is by no means the sole reason for the avoidance by the gouty of sugars and fats. With them, partly as a derangement of the general health, and partly on account of a want of alkalies in their blood, gastric digestion is almost invariably defective,* and, as a result thereof, butyric acid from fat, and lactic acid from sugar, become conspicuous and troublesome. If, however, the gouty man will consent to reduce the amount of albumen consumed per day to reasonable proportions, he will be gratified by finding that his powers of eating and of digesting comfortably, both fats and sugars, will soon be marvellously increased.

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* Chloride of sodium, or common salt, a substance which abounds in the blood, is supposed to be split up in the human body into hydrochloric acid for the stomach and sodium salts for the bile.

Of course all articles notoriously difficult of digestion—pork, eggs, cheese, uncooked vegetables, and especially pastry, must, unless in cases of idiosyncrasy, be avoided.

General Rules.—All worry and anxiety, in fact, everything that can affect the nervous system, should be avoided. Late hours, the inhaling of gas-laden air, excessive smoking or snuffing, emotional excitements, &c., all must be eschewed. The skin, by means of exercise and bathing, must be kept in good excreting order. If we have to deal with the variety known as "poor man's gout," then special attention should be paid to all measures conducive to the regeneration of the body. In cases such as this it is indeed sometimes advisable to feed the patient up, commencing, of course, with food and meats proportioned to his digestive powers. When delicate ladies exhibit symptoms of gout, it is generally of this latter variety.

MEDICINAL TREATMENT.

Wash out the urate of sodium from the tissues.—Nothing effects this better than copious draughts of hot water. One or two quarts per day may with advantage be consumed by the gouty. In the treatment of this complaint, I know of no single remedy at all comparable with this in efficacy.

Convert the urate of sodium into other urates that are more soluble.—This, again, is a very rational line of treatment, and one which rewards us with gratifying success. Now, the salts of potassium, and of lithium, are far more soluble in blood and lymph than the sodium salts. So we may order one of the following formulæ:—

Citrate of lithium, 60 grs.; carbonate of lithium, 30 grs.; bicarbonate of potassium, 80 grs. Any one of the above drugs and amounts may be selected and dissolved in eight ounces of a bitter infusion, such as infusion of quassia, and one-eighth part of the resulting mixture in half a pint of water, may be taken *three* times a day, before food.

In place of the last treatment, or as a substitution for it, if it should fail, iodide of potassium may be given. The actual *rationale* of its beneficial effect in gout is hard to give in a satisfactory manner. We know that it has the power of conveying lead and mercury out of the system, and we know that the presence of either of those metals favours gouty manifestations. We also know that iodide of potassium possesses a special power over the lymphatic system tending to remove waste. Whatever be the means by which it acts, it certainly does very often seem to cause a marked improvement. To prevent its depressing effects on the system, and with the object of supplying the bile with certain salts (chlorides), which are in gout often deficient, it is best combined with chloride of ammonium. Thus :—

Iodide of potassium, 20 to 40 grs.; chloride of ammonium 1 dr.; fluid extract of liquorice, 3 drs.; glycerine, 1½oz.; spirits of chloroform, 2 drs.; water up to 8 oz. One-eighth part in plenty of water thrice daily. The last three drugs disguise the disagreeable taste of the first two.

Change of air and scene, combined with medicinal treatment.—A visit to some mineral spring usually secures all these advantages. Bath, Buxton, Teplitz and Wildbad, are all hot springs which contain suitable ingredients. The temperature of the water assists the cure as much as do the contained salts. Besides the above, and often preferred to them, are the springs of Friederichshall, Pullna, Kissingen, Æsculap, and Hunyadi Janos, which contain waters rich in the sulphates of sodium and magnesium, and therefore, specially useful in cases where gout is complicated by plethora. Then, decidedly popular and rich in alkaline salts are the waters at Carlsbad, Vichy, Baden, Wiesbaden, Aix-la-Chapelle and Aix-les-Bains. I need scarcely add by way of caution, that no mineral spring should be visited nor its waters taken without a prior consultation with a competent medical authority. There are so many different stages of gout, so many different conditions of the system with which it co-exists, and such varying properties in the different kinds of mineral waters themselves, that the selection of a spring suitable to any one invalid is always a matter for thorough consideration.

Of course, all the above mineral waters and many more of use in gout, can be obtained ready bottled in England, but the drinking of them quietly in one's London bedroom is a very different thing from having to go early to bed, to take simple foods and necessary exercise, and to being compelled to walk to, and take the water direct from the spring three or four times a day, as is the customary *régime* at mineral spas. These bottled waters have their uses, however, for many gouty people will partake of them when they will not consume the equivalent of mineral contents if ordered in a prescription; because, forsooth, they regard the mineral waters as having been *providentially* supplied for man's use.

The salts contained in some of the mineral waters may be purchased in bottles. This is a very convenient way of taking the water. Thus, one or two teaspoonsful of Carlsbad salt may be dissolved in half a pint of hot water, and imbibed slowly before breakfast each day. This, besides conferring on the individual all the special virtues of Carlsbad water, will assist in maintaining a regular daily evacuation of the bowels, a thing of some importance in gout.

Bring the whole bodily health up to a good standard. In cases where, as a result of residence in hot climates, or of attacks of ague or other malarial fever, the liver is reasonably suspected of debility with chronic enlargement, the following combination is of the very highest value :—

Chloride of ammonium, 2 drs.; fluid extract of liquorice, 4 drs.; glycerine, 2 oz.; caraway water, 6 ozs. One tablespoonful twice a day in half a tumbler of water.

Twelve pills of the strength of 1 grain of quinine in each, are to be made, and one of such pills, in addition to the mixture, is to be taken twice a day.

In the gouty attacks of very weakly people, and of ladies and badly nourished individuals, a somewhat tonic treatment has, as regards drugs, to be frequently pursued. For such, one of the following prescriptions will be found useful :—

1. Citrate of iron and quinine, 1 dr.; iodide of potassium, ½ dr.; syrup of oranges, 2 ozs.; water up to 8 ozs. One tablespoonful thrice daily in water.

2. Iodide of ammonium, 1 dr.; spirits of sal volatile, 2 drs.; compound tincture of peruvian bark, 2 drs.; cinnamon water up to 6 oz.; one tablespoonful in water thrice daily.

3. Tartrate of iron and potassium, 1 dr.; bicarbonate of potassium, 1 dr.; Fowler's solution of arsenic, 1 dr.; water up to 6 ozs. One tablespoonful in water thrice daily, *after food.*

Then we have to consider the external applications suitable for various gouty twinges—neuralgia, lumbago, etc. These are successful sometimes in alleviating deep-seated pain. They are however, powerful poisons when swallowed, and must therefore be kept in specially shaped blue bottles to indicate plainly that they are not for internal consumption.

1. Chloroform, 1 dr.; hartshorn liniment, up to 2 oz.

2. Methylated chloroform, 2 drs.; turpentine, 1 oz.; soap liniment, up to 2 oz.

3. Menthol, 1 dr.; liniment of chloroform, ½ oz.; liniment of belladonna, ½ oz.; liniment of aconite, 1 oz.

4. Powdered cayenne, 30 grs.; oil of mace, 30 drops; liniment of turpentine, 4 ozs.; compound camphor liniment, 4 ozs.

The above are suitable for the deep-seated pains in persons of thick skin. They may either be rubbed in vigorously, or applied sprinkled on lint or spongio-piline, which may be tied over the seat of pain.

The following are more useful in the case of ladies and of children:—

1. Chloral, ½ oz.; menthol, 2 drs.; aconite liniment, 1 oz. soap liniment, up to 4 oz. External use. Poison.

2. Chloroform liniment, belladona liniment, aconite liniment, soap liniment, of each 1 oz.

Both these latter must be applied with gentle friction.

In addition to the above, hot bran-bags, hot flannels and prolonged friction with some simple oil, such as camphorated oil, to prevent chafing of the skin, are sometimes employed.

Electric shocks of medium power not unfrequently cause disappearance of gouty pains.

Then, in addition to the drugs I have mentioned, a multitude of others are employed in the treatment of chronic gout—colchicum, colocynth, aconite, veratrium, sulphides, strychnia, manganesium, opium, etc. They all may occasionally be employed to combat troublesome symptoms, but none of them possess any curative action, in the real sense of the word. Colchicum, a drug very extensively used in this complaint, and an ingredient in nearly all patent cures for gout, has a specific action in arresting the pain of gouty inflammation. It cannot be said to cut short the attack, nor certainly does it prevent rapid recurrence, while at the same time it possesses a depressing effect on the circulation. According to some it is by virtue only of the latter action, according to others by its peculiarly stimulating effect on the liver, that it effects relief of the pain; but in either case, unless for some special reasons and in the hands of a responsible medical man, it ought never to find an application.

A GOUTY ATTACK.

We have so far been discussing the gouty state, chronic gout or latent gout; but I must devote a few lines before leaving the subject, to the treatment of an acute attack of gout, say in the ball of the great toe, its favourite site.

1st. The diet must be at once lowered, milk and maigre soups in small quantities, skim-milk and soda, Vichy or potash-water, fruit jellies, ripe fruits, water gruel, barley water, rice water, tamarind water, whey, malt extracts with water, and very light farinaceous foods may all be taken, but, as a rule, particularly if the patient be plethoric, the less he takes at this stage, in the way of nourishment, the better.

2nd. A smart purge is usually the first medicinal step: three grains of calomel on the tongue, or a couple of blue pills, or a podophyllin pilule, followed, if necessary, in six hours, by a seidlitz powder, by a dose of citrate of magnesium, or by the old-fashioned black draught. Of course, if the patient be weak or delicate, but a mild aperient need be administered.

3rd. Then as to the special treatment for gout. One to two quarts of plain hot water a day. Ten to fifteen grains of bicarbonate of potash or ten grains of citrate of lithium in water every six hours, and a pill with from one to two grains of extract of opium in it at bedtime.

Some combine of the above indications numbers two and three together, and give a purgative and colchicum in one mixture, thus :

Sulphate of magnesium, 1 oz. ; sulphate of sodium, ½ oz. ; carbonate of magnesium, 1½drs ; colchicum wine, 80 drops ; glycerine, ½oz., spirits of pepperment, 60 drops ; water up to 8oz. One-eighth part in water every four hours till the bowels act very freely. The dose then to be halved and still taken at the same intervals.

The above mixture often mitigates in a rapid manner the severity of an attack in a powerful man.

Local treatment to the swelled and inflamed foot.—If the pain be in the toe, the leg should be raised so that the affected joint may be at a rather higher level than the rest of the body. If the attack be in the hand, that should be kept in a sling. The part should furthermore be at once covered by thick cotton wool, and this again may be enveloped in oiled silk. If in spite of the above, the pain be very great, flannels wrung out of poppy-head lotion, or out of a strong solution of carbonate of soda in hot water, may be applied frequently, or hot linseed meal poultices, or hot bran-bags may be used. If, however, as very often happens, the patient objects strongly to the necessary movement of the part connected with the application of hot lotions, either of the following compositions laid on lint may be substituted :—

1. Extract of belladonna, 2 dr. To be rubbed up with half-an-ounce of boiling water and two ounces of glycerine. A small amount to be spread thinly on lint, and applied to the gouty joint. To be changed every twelve hours.

2. Oleate of morphina (one grain to each drachm of oleic acid) a one-ounce bottle to be filled. To be very gently painted over the seat of pain with a feather, every twelve hours.

3. Chloral, 4 drs. ; camphor, 4 drs. ; thymol, ½ dr. ; menthol, 2 drs. ; veratrine, 20 grains. To be ground together in a mortar till a fluid results. The fluid to be painted over the seat of pain with a small camel-hair brush every two hours. This latter compound, to which I believe I can claim an original right, is often very efficacious. It is agreeable to the smell, and not messy.

With these few observations I close my remarks on gout, and on secondary digestion, and its failures. I have given but very short directions for an attack of acute gout, as I presume that the sufferer will summon medical aid. My next chapter will take up the very important subject of tertiary digestion, and will follow, as far as possible, the salts, grape sugar, serum albumen, and fats to their final destinations.

CHAPTER XIII.

TERTIARY INDIGESTION.

BEFORE we can understand the various derangements which flow from imperfect digestion of the foods that leave the liver by the hepatic vein, we must possess a clear idea of the whole circulation of the blood.

Blood consists of a fluid called serum, and of two kinds of corpuscles—the red by far the most numerous, but possessing merely mechanical powers; and the white endowed with independent life and motion. These corpuscles must be pictured as being constantly hurried along in the fluid part of the blood. We will suppose ourselves in the blood stream, and will commence our tour of the body at the spleen, which is one of the organs of the body which is credited with the power of making new blood-corpuscles.* We travel down the splenic vein to the portal vein, with whose blood we become amalgamated, and with it we travel straight on to the liver.

Here we at once are carried to a lobule, and in very small channels wander in and out among the small liver cells, till we run into a larger blood-vessel, which occupies the middle of the lobule. On looking round now, we find that a great change has taken place in the fluid in which we are travelling since we entered the liver. In the portal vein we were in company with a large amount of grape sugar and a kind of albumen called peptone. These left the channels when we were passing through the liver cells, and have been arrested by those bodies, to be stored and manufactured into suitable material for the great blood system we are about to enter. We, however, notice that a small quantity of grape sugar is dribbling into the channel where we now are, and that also a little albumen is coming in, but that this latter has undergone some change since it left us for the liver cells.

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* The red marrow of bones and the lymphatic glands are the other blood forming glands. The whole question as to the locality where corpuscles are made is still, however, *sub judice*.

There is, however, not much time to look round—on we must go, the channel in which we are, constantly being joined by others, from the different lobules; we pass on till at last in one big blood current, the hepatic vein, we leave the liver. Here we are again joined by large tributaries, till as one vast swift stream we are poured into the right side of the heart.

As we enter this cavity, we fill and dilate it; then it commences to contract, the doors (*i. e.*, valves) of the large vein by which we entered are shut behind us, and we are forced away up a different channel. This large channel, however, begins to divide itself into smaller and smaller ones, till at last we find ourselves slowly passing along a very narrow channel—so narrow indeed that the red blood-corpuscles can only proceed along singly and in Indian file. We are now in a capillary, the smallest kind of blood-vessel, which is in fact merely a tube made up of flat cells, so loosely joined together that, though the red blood-cells cannot escape, the serum and the white blood-corpuscles pass in and out of the vessel with the utmost ease. We do not, however, lose much of either of these latter here; but we notice that an extraordinary change is taking place in the red blood-cells, We are now in the lung, and running around the wall of one of its small air cavities. So far, the red blood-cells have been but of a very dull colour indeed, almost purple, in fact; now we notice that they are slowly getting of a higher and brighter scarlet red. As we examine the one in front of us more closely, we see the cause of this. It is allowing to escape, through the walls of the capillary into the air cavity round which we are circulating, the Carbonic Acid gas which it was carrying, and it is loading up with quite a different gas, Oxygen, a supply of which is every now and again being drawn into the air cavity. All the red blood-cells are behaving in precisely the same manner.

Now we leave the air cavities, and, being constantly joined by small tributaries, the current getting wider and stronger, we find ourselves suddenly thrown, pell mell, once more into the heart. But now we are in its left side, not in its right half, as before.

Once more we look round. In appearance, this side of the heart is almost identical with the other, and we are evidently to undergo similar treatment to that which we experienced there, for the cavity in which we find ourselves commences to contract, the doors by which we entered shut automatically behind us, and we are forced with great power into a very large channel.

Once in this large channel, we proceed along very rapidly. Every now and then, however, we give off branches here and there to the different organs as we pass them. In passing the kidney we remark that we lose one in particular of our fellow travellers, a substance called urea, which lay dissolved in the blood serum. This leaves us for good at this point, and is accompanied by a good deal of the fluid and a large amount of the salts in the serum.

But perhaps, before proceeding further, we had better enumerate our present surroundings. The channel we are in is now but small, for the branches that we have been giving off have had the result of gradually lessening its calibre ever since it left the heart. We have our bright-red blood-cells, our white cells, and our serum or fluid, but this latter is evidently made up of a good many different constituents; which we may analyse a little. We find that it consists of *emulsified fat*, which came into the current just before we reached the right side of the heart, as well as the *grape sugar*, *serum albumen*, *salts*, and *water*, which came from the liver. Besides these there are a few extractive and yellow colouring matters, but only in small amounts.

But we are dividing and subdividing again so rapidly that we are soon once more in one of those single walled capillaries of which we had experience in the lung; and we notice now that the serum is running rapidly out and mixing freely with the cells in a muscle of the leg through which we are passing. We also notice that the red blood-cells are allowing their oxygen gas to escape, as they did their carbonic acid gas, when in the air cavities of the lung, and that carbonic acid from amongst the cells is coming rapidly in, and that the red cells are loading up with this, and, by so doing, are fast losing their scarlet colour, and are becoming dark purple-red once more. With the carbonic acid a good deal of water is also entering our capillary.

Let us follow the blood serum, and passing out of our capillary, wander among the muscle cells and try to ascertain what is going on there, what they want with the oxygen and how they manage to have carbonic acid and water in such quantities to spare. Now we witness indeed a wonderful scene of activity. The emulsified fat and the grape sugar are uniting rapidly with the escaping oxygen, and are being *burnt.* The result of their combustion is, we notice, the same as that of a common tallow candle, namely carbonic acid and water; so that is the source of those two ingredients that were entering the capillary so fast. But surely, as a result of a burning candle, we have light and heat; the combustion in the cells is not, however, brisk enough to give off light—there is not a large enough proportion of oxygen present to produce that, but we have heat, and this the cells are using in much the same way as a steam engine does, and by means of it they are all working briskly away, contracting, expanding etc. This is easy enough to understand, but what is taking place with the serum albumen? The *precise* nature of the change which this (chemically speaking) troublesome substance undergoes in contact with the cells is not known to science. It is *certain* that the cells treat it, as the liver did the surplus not wanted for the blood, namely, they, by the help probably of the oxygen present, split it up and appropriate to their own uses all that they need for their repair; for this dead albumen in the serum, and this living protoplasm, of which the cells consist, are almost identical in structure—both are forms of albumen. Now, in the case of the liver, we had a bye-product called urea, formed as a result of the splitting up of albumen. In the tissues we have either this same product, urea itself, or one or other of the chemical series to which it is very closely related, such as glycin, a compound of an Amide (urea is an amide) with an acid (acetic acid). In health they are certainly not both present.

We will presume it to be glycin, for the balance of scientific opinion leans decidedly that way.

We have now, therefore, in the blood current glycin and various salts and water. These are collected in the lymph spaces, which run on (directly or indirectly) into capillaries, which joining others, form a channel (now called a vein) which gets larger and larger until it reaches and joins the hepatic vein, mixed with the blood of which it again reaches the right side of the heart. It does not, however, go through the liver.

The salts in the blood have assisted the various chemical changes.

Such is tertiary digestion, or as some prefer to call it, assimilation—though the amount of nourishment absolutely assimilated is infinitesimal, and that little is assimilated only after the serum albumen has been split up, probably by means of a ferment. We shall now be able to proceed by an easy step to the comprehension of some of the disorders of this process. I say *some*, for a mere enumeration of all that are the direct result of tertiary indigestion would of itself make a formidable list; and though we know that nearly all our diseases are a direct consequence of such defective action, medical pathology has not yet been able to fix the exact seat of the failure, in the vast majority of the disorders.

We shall review first of all a few of the derangements which have been traced to a deficiency or excess in amount, or a defect in kind, of the salts; then to those flowing from a deficiency in combustible material, or a deficiency of oxygen to consume them; leaving to the last one or two very important diseases that have been clearly brought home to a failure in the final destination of albumen.

Deficiency of salts.—When common salt (chloride of sodium), the main salt which occurs in healthy human blood, is taken in too small amount, loss of flesh results, and serum albumen appears in the urine. This shows us at a glance what a very necessary part in the final conversion of albumen this substance plays. If common salt be absent from the diet altogether, that is to say, if it be not only withheld from food, but only water that has been distilled, be supplied in place of spring or river water, and no article of solid food that contains any but a trace of salt be administered, very rapid wasting, leading speedily to paralysis, is the result. Over-feeding with salted foods, on the other hand, has led to such very rapid metamorphoses of the cells in the tissues, that a fatty degeneration of them has been produced thereby—a condition also seen in phosphorus poisoning. When certain of the organic salts of potash, which occur in fresh meat and vegetables, and especially in the lime fruit, are for long withheld, *scurvy* results ; a disease rarely at the present day witnessed among sailors, but not uncommon amongst seamstresses and other poor inhabitants of towns who live largely on tea and white bread. This disease is very amenable to treatment, recovery setting in rapidly when the necessary salts are taken, though it may be a long time before the patient's strength is fully regained.

A want of iron, which is a natural constituent of the red colouring matter of the blood, tends in young persons, particularly in young unmarried females, to produce certain symptoms to which I have already alluded, and which in their aggregate receive the name of anœmia or spanœmia. An extreme pallor, accompanied by breathlessness on exertion, palpitation of the heart, and certain stomachic symptoms, accompanied with pain, are salient characteristics of this derangement. Such a condition of matters is, however, by no means incompatible with plumpness ; in fact, as we shall see later on, a poor condition of the blood often directly tends thereto. At one time—and possibly the custom may still prevail—it was, among cattle dealers, the habit to bleed calves that were being fed for the market, for such loss of blood was found to be conducive to rapid increase of weight.

In young persons who suffer from anœmia, a course of medicine containing iron, though such may be called rather a *food* than a medicine, has a markedly beneficial effect, and is followed by a subsidence of the most troublesome symptoms. An apparently similar condition in those who have reached or passed middle life is not unfrequently witnessed, but the administration of iron in their cases rarely effects the least good, even if there be no organic disease present to account for the poverty of blood. Sometimes in these latter, a curious and very rapidly advancing form of anœmia, which has received the name of "progressive pernicious anœmia," is witnessed. This disease proceeds quickly to a fatal termination; but all efforts to find a physical basis for it, in the bodies of its victims, has so far been attended by no convincing result. Both it and the milder anœmic conditions of middle and advanced life are probably due to defects in tertiary digestion, brought about by some failure of the all-controlling nervous system.

In rickets and in osteo malacia, the latter a rare disease, seen most commonly in women just after middle age, and characterised by a gradual softening and consequent bending of the bones, accompanied by marked loss of stature, the salts of lime necessary to proper bone formation are wanting. In the former of these complaints, such salts have never found their way in proper amount to the sufferer's bones; in the latter they have, owing to some perversion of the digestive process, been re-absorbed by the blood. Sometimes in rickets, an administration of foods rich in phosphates will improve the condition of matters, and even effect a total cure. For the latter disease there is no known remedy.

A not uncommon derangement which occasionally passes into an incurable disease, is phosphaturia, a condition in which phosphoric acid is constantly passing out, in excessive quantities, by the urine. If a temporary condition, it is usually due to mental anxiety, worry, &c., but the severe and fatal cases, like those of diabetes, depend upon actual structural brain or nerve disease.

In many other diseases—purpura, gall-stone, etc., there is very strong reason to conclude that a deficiency in the salt elements of the food has a direct bearing on the causation of the disease; but as the connections between the deficiency and the supposed result have not been very clearly made out, I prefer leaving the subject here to making statements which might be open to question.

The list of elements found in our blood and tissues that do not go to the formation of protoplasm, and therefore are present as inorganic salts or compounds, is a formidable one, and the relationship which these bear to health opens a large and hitherto but little trodden field for the work of investigation. That stores of highly important knowledge will eventually be derived from a more thorough study of this subject than it has yet received, we may very justly conclude, when we consider that for thousands of years, metals and inorganic salts have been administered to man for nearly every complaint, and by every school of medicine, and have certainly affected very materially his structure, and let us hope in the majority of cases in a beneficial manner. Yet, at the present day, there is no living man who can give a *thoroughly satisfactory* scientific account of how half-a-dozen, out of the hundreds of inorganic compounds which the Pharmacopœia contains, will act when administered to a man in health or in disease. In this department all is yet dark. Theories abound, facts are wanting.

THE FAILURES OF TERTIARY DIGESTION IN REGARD TO THE DISPOSAL OF FATS AND SUGAR.

When neither the fats nor the sugars (or starches)—in chemical language when neither the hydrocarbons nor the carbohydrates are supplied to the body in sufficient quantity, what should we expect to be the result? At first sight we should be inclined to answer, loss of heat and energy, since their destination is combustion, and the combustion sets free heat energy. This, however, is not by any means such a very early result of the withholding of these substances as we might expect. If a man be altogether deprived of food, and therefore have neither fats nor sugars to eat, and merely water to drink for a couple of days, there will probably no loss of flesh result, a sufficient reserve of food being obtained from the intestines and stomach to maintain weight. Then the fat which is deposited in various parts of his body is slowly consumed. When that has gone, the tissues of the body itself are gradually drawn on to supply heat and energy, till the individual has lost about 2-5ths of his weight, when death results. The fall of temperature is, however, throughout but very small, for the combustion of the reserve fat and cell tissues I have enumerated maintains it. If the starving individual be kept in warm air, he will live much longer than if exposed to a cold temperature, as he will lose much less of his heat by radiation.

But it may be justly remarked: If it be simply a question of what result will follow the abstraction of fats and sugars from a dietary, why not let the individual have albumen? For the simple reason that albumen, in its metamorphoses in the body, does yield a little fat, so small an amount, however, that for the sake of clearness I omitted all mention of it in my sketch of tertiary digestion. If albumen only, in the form of the leanest of lean meat, be allowed, death results just in the same way as when no food is allowed, but its advent is slightly delayed, and the symptoms are masked by the derangements incidental to the consumption of such a dietary.

Thus the deficiency of fats and starches or sugar in a dietary does not lead to noticeable loss of temperature, but to *leanness*, and eventually to starvation.

An excess of fats and starches leads conversely to *corpulence*, for the unburnt surplus is stored up as fat. A deficiency of oxygen leads to the same result—namely a storage of unconsumed material.

Undue leanness or thinness results then from a deficiency of starches (sugars) and fats,—to a much smaller extent to a lack of albumen. Now, an abnormal amount of thinness is but very rarely due to want of food, for, after the period of growth has passed, but a very small amount of food is really necessary to maintain the body weight. The condition is nearly always due to defective powers of digestion and absorption by the stomach and bowels. Spareness of body, unless it be rapidly progressive when it is nearly always due to some distinct disease, such as consumption, need not as a rule excite alarm, and is much more compatible with health, activity and longevity than the opposite condition of corpulence.

The following is the table of weight in comparison with height, compounded from the mean of thirty Insurance tables :—

Exact height.	Weight.	Exact height.	Weight.
5 ft. 1 in. ..	120 lbs.	5 ft. 7 in. ..	148 lbs.
5 ,, 2 ,, ..	126 ,,	5 ,, 8 ,, ..	155 ,,
5 ,, 3 ,, ..	133 ,,	5 ,, 9 ,, ..	162 ,,
5 ,, 4 ,, ..	139 ,,	5 ,, 10 ,, ..	169 ,,
5 ,, 5 ,, ..	142 ,,	5 ,, 11 ,, ..	174 ,,
5 ,, 6 ,, ..	145 ,,	6 ,, 0 ,, ..	178 ,,

Variation of 7 per cent. in excess or in diminution of the above proportions is allowed. Beyond those limits an extra premium is charged.

Thus, we see by the above table that a man of 5 ft. 8 inches in height, should weigh 155 lbs. He may exceed this by 7 per cent., and so reach 166 lbs., or go below it by an equal amount, and so reach 144 lbs.

The above applies very fairly to males, indeed, the calculation is the outcome of many years of experience by very sharp business men. In the case of females, such a table is of very little value, as, owing to certain special conditions, not dependent even on pregnancy, their weight may exhibit, consistently with perfect health, much wider margins.

What are the means, then, to be employed in cases of extreme spareness, to bring the body up to that weight which is most consistent with its safety and health?

Generally speaking there are very few cases of spareness of body in which, unless there be some marked disease to account for the condition, it is necessary to interfere. Persons who are naturally spare do not usually thank the doctor who successfully devises means of fattening them. As they grow stouter they find that their powers of exertion, mental and physical, decrease, and that languor, depression, and drowsiness are apt to become troublesome. Therefore, as a practical hint I may lay down this rule—that in the case of persons whose health is satisfactory, no interference with the object of simply fattening them, is advisable. Such a remark might appear superfluous; but a request for some useful hint whereby plumpness and a comely roundness may be secured is very commonly made to the medical man by members of the fair sex. If a disease be present—and in all cases of undue thinness the possiblity of such a contingency should be duly weighed,—we must of course treat the disease; for on its removal alone will depend the ultimate success of our endeavours.

But supposing it be regarded as necessary, in any individual case, to lay down rules for fattening one whose sole complaint is spareness—we should then proceed thus:—

THE DIGESTIVE ORGANS.—*These should be put into good condition.*—This is essential. For this purpose little in the way of medicine is necessary: a few doses of rhubarb and soda may perhaps be given, but as a rule all such medication does harm. Suitable outdoor exercise must be taken. This should in no case be excessive, for that would make matters worse, but only sufficient—just sufficient—for the maintenance of health and for the provocation of appetite. No bitters, no quinine, no miscalled tonics, to produce appetite. Sometimes, no doubt, we must have recourse to them, but when we do, it is a confession of weakness, and does not prognosticate eventual and lasting success. The human body is so perfectly a machine that it must never if possible be viewed, in a physiological sense, piecemeal. If there is no appetite, there is usually no digestion, and if no digestion, there is something wrong somewhere, probably with the whole mechanism; and therefore we must treat the *whole body* with fresh air, with exercise, with amusement, with cheerful thoughts and conversation, with bathing, etc. : these are all-round tonics, and on them alone should any great faith in ultimate success be built.

(2.) REST.—After necessary exercise for mind and body has been secured, the balance of the time should he devoted to *rest.* But by rest I do not mean a supine position on the sofa or bed for twenty out of the twenty-four hours, but quiet easy meployment that involves no effort, no forced strain, no nerve worry. Always must it be borne in mind that the nervous system governs the whole body; if you derange it, the whole system will inevitably suffer.

(3) CLIMATE.—If the appetite be good—and some spare people have remarkably good appetites,—the effect of a relaxing air has often a wonderful result in causing an increase of weight; but if on the contrary, lack of desire for food be prominent, a bracing air, such as that of Margate, is to be preferred—not mountain air, for that is usually too sharp, and existence in an elevated region implies, in most cases, a good deal of daily effort in the way of climbing, useful for the corpulent, but not advantageous in a fattening process.

(4.) DIET.—The following articles possess decided fattening properties. The patient must construct his own dietary from them.

Fats of all kinds. Cream, chocolate, cocoa, new milk, eggs, bacon, nuts, fat meat, eels, butter, cheese, oatmeal, and maize meal, are examples of substances rich in fat.

Sugars and Starches.—Peas, lentils, beans, whole wheat meal, barley meal, rye and maize meal, bread, biscuits, dates, figs, potatoes, carrots, turnips, parsnips, beetroot, arrowroot, sago, tapioca, rice, treacle, maple, cane, grape and milk sugars, ripe fruits.

Alcohols.—All forms of alcohol tend to increase weight. They should, however, be of course taken with the strictest limitations. Malt liquors, good Burgundy, old Port, Madeira, Constantia, Bucellas, and Tokay, are among those most conducive to corpulence.

As regards the eating of meat.—This substance conduces very little to the production of fat, but a certain amount of it, as fat as possible, may be taken with two of the daily meals. As a rule, the more restricted is the use of meat, the better will be the power of digesting the fatty articles of food; and, in the increasing of weight, it must always be kept in mind that the fats head the list; then a long way behind come the starches and sugars, then with another large interval, the meats, and close behind them, the alcohols.

Special articles of food that are fattening.—All malt extracts, all malted foods, all preparations of fat, pancreatised and emulsified oils of all kinds. Very many of the special foods in the market—Ridge's, Mellin's, Œttle's, Savory and Moore's, Du Barry's, Jones's, Benger's—are very efficient. Then there are the special foods of a different order, such as kindermilch, cremor hordeatus, koumiss, etc. Cod liver oil is the best of all known fatteners, and when it can be taken plain and not as an emulsion, it seems to exhibit its most powerful results. For some years I have been in the habit of using it in the following formula, one in which the fishy taste is very well disguised:—

Cod liver oil, 3 oz.; lime juice, 2 oz.; glycerine, 1 oz.: mix. Shake the bottle. One tablespoonful two or three times a day, after food.

The fat produced by liquid oils is not, however, equal in use and stability to that produced by the *solid* fats. This is due to a difference in their chemical composition.

MASSAGE.—This system of fattening was introduced a few years ago by Dr. Weir Mitchell, an American physician of eminence, to whose book, "Fat and Blood," I must refer the reader who may wish for full information on the subject. Stripped of all mystification, it consists of three principles:—(1), complete isolation of patient; (2), passive exercise of the patient's muscles by means of thorough and systematic shampooing—so-called massing—of the body at the hands of a skilled attendant; and (3), the administration of a gradually increasing dietary. The massage system found for a time great favour in England amongst a class of well-to-do invalids of the neurotic type, and in many cases it effected a cure, not only of their physical, but what was of infinitely more importance, of their morbid mental and moral condition. Many lay minds were puzzled as to the reasons underlying its frequent success, which were clear enough to the medical mind. In the first place, the kneading or massing of the muscles served as an equivalent for wholesome muscular exercise, which this class of invalids rarely gets, and which, indeed, on account of their general state of demoralisation, they are not often able to avail themselves of, by reason of the resulting fatigue, even when the opportunity for such exercise is afforded them. In the second place, the passive exercise thus obtained at the hands of the masseur or masseuse—for the demand soon created a supply of individuals who laid claim to special powers of kneading, and for whom no English name was sufficient,—removed an enormous amount of waste material that had been accumulating for long in the lymph spaces of the invalid's muscles; and thus rendered tertiary digestion or assimilation possible, and created not only a demand on the part of the body for food, but a power of really utilising the supply. Very naturally, a marked increase of weight resulted.

But wherein lies the need for isolation? The answer to that question, to be adequate, would fill volumes. I will give as condensed an explanation as possible. Leaving aside for the present the rest of the nervous system, and confining ourselves to the human brain, we shall find that it possesses three very distinct power, viz., reflex power, storage power, and power of association of ideas. Now, the class of mind depends entirely upon the relative development and utilization of these three. The lower animals possess little but the reflex centre, which lies at the *base* of the brain. Many of them, and all the higher animals, possess also a small storage or memory centre, which occupies a higher portion, corresponding nearly to the centre of the brain in man. Some animals possess in some measure, none to such a large extent as man, the third centre, namely, that connected with the "association of ideas."

Now, all impressions must go first to the reflex centre. Some go no further, but are sent back at once by other nerves which set up the necessary movements—such as those of the heart, lungs, and intestines, which go on night and day, and are essential to life. The stimulation of the blood constantly poured into the heart supplies the incentive which reflexly ever keeps the heart in rhythmical action, and impressions of a similar kind keep the lungs, kidneys, intestines, etc., also at work. Other impressions, such as those from the eye, ear, and skin, go to the reflex centre, and are here divided, part of the impression or nerve current, being sent back as a reflex action, and part going on to the storage centre. For example, if I see a flash of lightning, I involuntarily blink (reflex action), but I remember also that I have seen it (storage action). Just close to, in fact in contact and communicating with the storage centre, lies the centre for association of ideas.* Here the various impressions may be said to mingle, and group themselves, the mental equivalent for which is perhaps best conveyed by the word, "deliberation." The result is thoughtful action, for action of some kind is the *sole* result of all the currents which leave all the centres; but the *complexity*, *kind*, *and rapidity* of action depends upon how far the impression has gone, and how long it has remained in that part of the brain connected with the association of ideas, and on the healthy and perfect structure of that part. Thus we have :—(1), Simple reflex or purely *automatic* action—this is rapid ; (2), *Emotional action*, result of some reflex, some storage, and some association of ideas (or deliberation); this is not so rapid as the automatic, but is far quicker than the next class; (3), *Deliberate action*, resulting from a long stay of the impression in the centre for the association of ideas. This action does not follow rapidly on the impression, may be delayed in the centre for weeks, months or years, and is the product of many combined impressions. This last class of actions is seen at its best in healthy civilized individuals, who have inherited good brain tissue, and have by working it wisely and systematically, brought it to a high pitch of development.

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* There is an intimate connection between the centre for memory (or storage centre) and that for the association of ideas, in fact some neurologists assert that they are one, but the simple fact that a good memory is often found with indifferent judgment is alone sufficient to prove that they are to some extent distinct.

At the commencement of this book there is a diagrammatic sketch of the principle on which the nervous system acts. The reader will, of course, understand that *many millions* of impressions are travelling per hour, running to the different centres and producing the varying results of which I have tried to give a simple explanation.

Now, what has this to do with *isolation* of the patient in massage? Everything, for the class of mind that is profoundly affected by occasional isolation is the emotional. The mesmeric, the cataleptic, the hysteric, the hypochondriac, the fervid, the impulsive, the passionate, the neurotic, the spiritualistic, the hypnotic, have all a badly balanced and badly working centre for retention and association of ideas, and may be spoken of as emotional in type. The want of storage power in the emotional is somewhat amusingly evidenced by their inability to keep secrets. Their whole nervous system is, as a rule, of an unstable order; such persons are often said to be sensitive, that is, an impression which, acting on a nerve ending, should convey but a weak steady nerve current to the centres, produces in their nerves irregular and impetuous currents to the brain, and rapidly returning ones therefrom. They are both emotional and impressionable, and the result is that they are strongly and quickly influenced by their surroundings. Their nervous system seems also, perhaps as result of habit, specially responsive to certain classes of impressions—sympathy, affection, praise, blame, etc. Such people get out of tone, their digestions become deranged, partly from want of exercise, partly from defective nerve action. The lower the physical strength falls, the more exaggerated becomes, as a result, the nerve sensitiveness, for the nervous system depends for its proper strength and abilities on the general nutrition, just the same as every other system. Sympathy and affection are now lavished on them. Too often such sympathy comes from persons of their own type. Now the invalid enters what is scientifically called a "vicious circle." Sympathy acts on impressionable nerves, producing all kinds of effects, one of which, at any rate, is further interference with the general nutrition, and in proportion as this advances, the sympathy *also* increases. Such invalids pass months, even years, in bed or on the sofa, their state often rendered ten times worse by the unwise direction of their attention to one organ, such as the womb, deranged perhaps to a slight extent, though the complaint is accredited by their lady sympathisers with mysterious and dreadful effects, and forms the basis of increased floods of sympathy.

Now, massage takes the patient out of the vicious circle. Supplies of sympathy are cut off. Not even the husband must exchange a word with the wife. If he, or any friend, be allowed access to the patient, the good achieved is undone. The medical supporters of massage are well aware of this. A kind, but firm, nurse and masseuse, and a medical man of good sense and determination, are the only individuals who visit the patient, and in six weeks the feeble, wan, morbid invalid who could barely crawl across a room, is transformed into the active, plump and "comely" (I have added this last word as a counterpoise to my other remarks) young lady or British matron.

Sometimes the patient is of the male sex. Dr. Lauder Brunton, in his book on the Disorders of Digestion, gives photographs of a man taken before and after he underwent a course of massage, and I take the liberty of copying the foot note from page 79 of that work :—

> "This patient wrote me a letter regarding massage, which is so important that I quote it. He says : 'Will you allow me (as one who *knows*, having undergone the whole thing), to *very strongly* recommend you not to attempt *any* case without *insisting on isolation. This is of the utmost importance.* Do not attempt half measures, or you will find the case will fail and you will get disheartened. Even in my own case, though I was most anxious to get well, I feel sure it would not have succeeded had I tried it at home.' 'Notwithstanding this advice [says Dr. Brunton] I *have* tried half measures, and have found my patient's prediction verified by the failures of these attempts."

Such are Dr. Brunton's words; the italics are his patient's.

Of course, I must not be held for a moment to assert or to maintain that fit subjects for massage are of defective intelligence. On the contrary, their powers of perception are often abnormally keen, and their judgment, if rapid, on account of their good perception, often remarkably accurate. But, with emotional people, as with emotional nations, *self-control* is defective, their governing power is largely wanting, they don't steer well. Their ideas do not remain long enough in that topmost centre of all, but are carried away in the form of impulse, of action, of some sort and kind. The Celt is impetuous, quick in thought and action, brilliant, fervid, demonstrative; every impression conveyed to his brain is rapidly converted to action of some sort. The Anglo-Saxon, or his cousin, the Teuton, is thoughtful, slow, silent. The impressions are stored longer in his brain, and result in those methodical, practical, business-like actions for which the Celt has a natural antipathy and contempt. The individual in whom massage can work miracles has, in short, a celtic nervous system, which has usually been both overworked and feebly nourished.

We will now turn our attention to the treatment of the opposite condition to that of leanness, namely, *corpulence*, or *obesity*. It is a much more serious and more common derangement than the former..

CORPULENCE, OR OBESITY.

We know already that fat is laid up in certain tissues of the body (the connective tissue), to serve as a store of reserve food in case of necessity, to give roundness to the general contour of the body, and, to some extent, being a bad conductor, to serve as an economiser of the heat generated in the individual. Very stout people, however, often suffer more than do thin ones from a low temperature. This is due to the fact that, owing to the great deposit of fat on the muscles, and especially on that round muscle, the heart, the circulation of their blood is often weak, and the hands and feet, as a consequence, obtain but a poor supply of it. It is mainly this interference with the heart's action that constitutes the danger that obese persons run and which renders a long duration of their life unlikely.

The causes of obesity are not far to seek. We know that when we consume food in excess of the supply of oxygen to the tissues, the excess is stored up as fat. It is true that albumen (lean meat) makes, at the best, but little fat, but it saves other foods from being consumed. The same is true of the starches and sugars. They, even in excess, are not easily converted into fat in the body; indeed, there are excellent observers who deny that they ever form fat, but they certainly save the fat in the body from consumption, and, therefore, tend indirectly to the production of obesity. The same is true of alcohol—and even gelatine possesses this power. Therefore, whenever from any cause, the amount of food in the blood and tissues is in excess of the oxygen supply, in other words in excess of combustion power, there will be, unless the food be strongly at variance with an ordinary dietary, a tendency to the production of obesity.

Excessive eating, if the primary digestion be good, will tend therefore to produce it. The more fat there is in the food consumed, the more marked will be the result.

The drinking of alcohol will have a similar effect. Malt liquors, by the sugar they contain, have an additional food value.

Lessened breathing power, by supplying less oxygen, will have an equal result. Habits of indulgence, want of exercise, etc., are therefore often active causes. It is this lessened breathing power which renders it a matter of such great difficulty to reduce the weight of corpulent people. When the ratio of weight to height, given on page 238, is passed, the breathing power is, owing to deposits of fat on the muscles, interfered with. Indeed, we know by experience that stout people are short-winded. This diminished inhalation of oxygen, therefore, spite of a reduced dietary, will often baulk the best endeavours of the doctor, unless he can induce his patient to take a gradually and cautiously increased amount of exertion, when the deeper and more frequent respirations necessitated thereby will furnish the required oxygen.

Diminished number of oxygen carriers, i.e., red blood-corpuscles will lead to the same result. Thus, as I have already pointed out, young women who suffer, not unfrequently before marriage from this deficiency, become plump. When the sexual system is artificially destroyed, as in castrated and spayed animals, or is torpid, as in women after what is called the climacteric (about forty-five years of age), there is always a marked tendency to fat deposits. In women this is often due to a poverty in red blood-cells. In castrated animals, and in eunuchs, the direct cause is not so easy to trace, but the diminished activity of mind and body lead to a diminished need by the body for power, and therefore for heat and for substances that are combustible. Many chronic lunatics become hence extremely fat, from sheer torpidity of mind, whilst violent maniacs lose flesh during the periods of excitement.

I am inclined at this point to add a theory—namely, that in some cases a failure of the liver [to transform albumen, may be a further cause of obesity. Normally a *little* fat is formed from albumen, and it is more than likely that in certain weak states of the liver, fat, far in excess of the natural amount, is produced.

The effect of sex in obesity.—There can be no doubt that very different rules of treatment are required for the two sexes in dealing with this disease—for corpulency is a disease. In women, fat is not such a source of danger as in men, and one should therefore always be more cautious in endeavouring to lower the weight in the fair than in the opposite sex. Before marriage, after the birth of a child, especially if it be not nursed by the mother, and after forty-five years of age, there exists in women the *natural* tendency to increase in weight of which I have spoken. At such periods I do not, as a rule, think it wise to intervene with a lowering diet or to advise the employment of other reducing means, unless there be some very grave cause for it. Elderly women, again, have a natural tendency to be much fatter than men of equal age. In both sexes it is most inadvisable to interfere in advanced life. We may, indeed, banish the fat with great ease, but all means of restoring weight, should an excess have been taken away, is usually lost for ever. With these cautions, I proceed to the question of the means at our disposal for the *cure* of corpulence.

Reduction of diet.—The diet may very cautiously be lowered till, as ascertained by weekly, or more frequent, weighings, the body weight steadily declines. The more slowly this decline can be accomplished the better.

The kind of diet.—The following articles of food should be, in large measure, or completely, abstained from. Milk, cream, custards, sweet cakes, sugars, syrups, beetroot, peas and beans (including lentils), parsnips, preserves, figs, raisins, nuts, potatoes, farinaceous puddings, sweet wines, malt liquors, white bread, butter and oils (the latter may be taken in salads); fat meats, such as bacon, goose, etc.

The following are among the articles from which selections may be made, and the respective amount of each that is necessary:—

Of Albumen.—Lean beef, or mutton, poultry, game, fish, all fresh, salted or cured, except salmon, eels, sardines, mackerel, and herring. Eggs and oysters sparingly. Of the above, per day, from 6 to 10 oz. will as a rule be sufficient.

Of fats.—Butter, dripping, or other form of fat, 1 ounce.

Of starches.—6 to 8 ozs. per day. Among these, brown bread, toast and stale white bread, are best.

Of other articles of food, such as the following, 4 to 5 ozs. Watercress, lettuce, mustard and cress, parsley, turnips, celery, plums, cucumber, pickles, cabbage, apples, pears, melons.

Beverages.—Half a pint of light wine (white) may be allowed, or raspberry vinegar or lime juice with water. Fluid should be taken sparingly, and in just sufficient to assuage reasonable thirst.

Coffee and tea with little milk. Saccharine should be used as a sweetener in place of sugar.

Exercise.—This is the most important item in treatment. In fact, where possible, it is better *always* to attempt a decrease of weight by this means *exclusively*.

Systematic bathing.—A hot bath twice a week. A cold or tepid bath each morning. A Turkish bath once a month.

The production of much perspiration.—This is a natural result of exercise, but if the skin does not respond easily to that agent, the wrapping of the body in heavy flannels may be had recourse to during a part of the day's exercise.

I subjoin the system of Dr. Oertel, the greatest living authority on the reduction of obesity.

His patients he divides into two classes. Those in whom it is necessary merely to reduce fat in order to restore them to health, and those whose hearts have been seriously injured by the weight of fat. In the former class, vigorous exercise is enforced, in the latter, cautious and gradual exercise, a rather fuller meat diet than the others, and the administration of iron. In the majority of cases this is the dietary he recommends, or rather administers, for he keeps an establishment devoted to his speciality. Morning and afternoon a small cup of coffee with milk and sugar, and with the morning coffee 35 to 70 grammes of white bread-and-butter; at noon, no soup, but 200 grammes of beef, 50 grammes of lettuce or the like, and 100 grammes of fresh fruit; for supper, some caviare, two eggs, 150 grammes of meat, and 150 to 200 grammes of light white wine. Later, when a portion of the bodily fat has disappeared and the circulatory disturbance is relieved, the daily dietary may be increased by adding 100 grammes each of fish and pudding to the dinner, as well as 200 grammes of wine, and to the evening meal some bread and cheese. Nevertheless, this increased allowance is only admissible when, by hearty exercise, preferably mountain climbing, the consumption of carbon (present in the foods) is augmented and the system requires more nourishment. In conclusion, it may be said that Oertel's daily diet scale consists of 155 to 170 grammes of albumen, 25 to 50 of fat, 70 to 110 of sugar and starch, and 900 to 1300 of fluids. Twenty-eight grammes make approximately one ounce avoirdupois.

The above dietary is somewhat more liberal than that usually recommended; but it must be remembered that Dr. Oertel most wisely relies on *exercise* mainly for his results.

Banting's system has long since passed away. It had two radical faults: it allowed too much fluid—and fluid, according to most authorities, promotes the absorbtion of foods; and it contained, under the erroneous idea that meat did not make any fat, a far too large proportion of that element.

Medicinal treatment.—I shall say very little under this heading. As a general rule, beware of drugs that diminish weight, as they can only do so by interfering gravely with some of the digestive organs, and may, when taken with the view of merely reducing weight, finish by injuring irrevocably the digestive apparatus and leading to life-long misery and early death. Almost all drugs, and almost all diseases, reduce weight, and it is almost as reasonable to acquire and rely on one of the latter as on the former. Laxatives may occasionally be used as adjuncts to general treatment. Perhaps the mineral waters of Pullna, Marienbad, Ems, Hunyadi Janos, Carlsbad, and Vichy, are the best to select for the purpose. The extract of bladder wrack (a common and familiar seaweed) is the basis of most of the fat-reducing medicines in the market. Of the liquid extract of this drug, the dose varies from 1 to 2 teasponsful three times daily in water, before meals. It acts by obstructing digestion.

THE ALBUMENS IN TERTIARY DIGESTION.

We have considered the more common of the derangements which may flow from the mal-digestion in the third and last stage, of the salts, the fats, and the starches (sugars). It has now become our duty to look into the consequences arising from a failure in the breaking up and elimination of the waste from serum-albumen.

When the serum-albumen has penetrated to the cells, it is said to be broken up, that is, it is, by a chemical power probably resident in the tissue cells, disintegrated and divided into several different substances of simpler construction than the original, though even the best authorities on physiology are ignorant as to the *precise* nature of the process. As far as one can say, the albumen is apportioned as follows:—Part goes to repair cell structure; part (a very small one, about 11 p.c. according to Drs. Landois and Stirling) goes to the formation of fat. The residue is represented by a large variety of chemical substances, derivatives or compounds of ammonia, and known as Amines, Amides, and Amido-acids.

Now, it is with this residue we have to deal, but the number of substances that are included under the amines, etc. is legion. I shall therefore select amongst them one, glycin, which in amount probably outweighs the others combined, and whose chemical powers and relationships have received some little attention, and which I therefore feel justified in taking as a type of the rest. This glycin, after being rejected from the cells, finds its way, with the other fluid constituents of the blood, into the lymph spaces; thence it ought to be pumped by the action of the muscles in whose connective tissue the lymph spaces are situate, into the veins. Now suppose, as a result of defective action of the muscles, this waste be not got rid of, but be allowed to accumulate; suppose that the cells themselves are losing strength, and are unable to effect the necessary changes in serum-albumen, or that a poison which has found entrance into the system paralyses their efforts, or that the nervous system which supplies them, directly or indirectly, with power, be deranged; and it will not require a great effort of the imagination to suppose that glycin may not be produced at all, but that one of the same chemical series to which it belongs, and whose difference in composition from itself depends merely on a different arrangement of precisely similar atoms, may be substituted for it; just as in the liver, uric acid instead of urea is sometimes produced. Some observers maintain that glycin, or glycocine, as it is sometimes called, is always made by the cells from serum-albumen, but undergoes change afterwards; others that it is always made, and goes to the liver to be changed into urea there, and that in certain deranged conditions of the system, uric acid partly replaces the urea, as it does in gout; others again, that the liver converts some glycin to urea, but leaves the balance untouched, and that it is the contact of glycin with urea which under certain conditions of heat, etc.—such as are found in the body, results in uric acid. The whole question is still *sub judice*, and but one thing is certain, namely, that urea is always, and uric acid is occasionally, the direct or indirect result of the breaking up of serum-albumen by the tissue cells, just the same as it is occasionaly the result of the action of the liver cells on that form of albumen (peptone) from which it is derived. The disease that the presence of this uric acid formed in tertiary digestion produces is called RHEUMATISM.

But if the same poison, uric acid, be the cause of both gout and rheumatism, how is it that two diseases very different in symptoms, in duration, in effect, and in frequency of recurrence, result therefrom?—It is impossible to answer that question in a satisfactory manner. I can only give as an explanation that, though uric acid in rheumatism be the *main*, it is probably not the *only* poison, at work; and that the uric acid in this latter complaint is, in my opinion, and in that of excellent observers, produced in the muscular tissues themselves, and either deposited there or pumped by them along the lymph spaces into the nearest joint, and that it is rarely in rheumatism produced by the action of the liver; in fact, that this latter gland plays but a minor part in the causation of the complaint.

Returning once more to the region of facts, we know that the result of an imperfect final digestion of serum-albumen is rheumatism. Now let us look at the causes which lead up to it.

(*a*) A failure in the digestive power of the tissue cells. This coincides with experience, for rheumatism is *the* complaint of old age and decay.

(*b*) *Overwork of the cells* by a constant over-supply to them of albumen. This again squares with a commonly recognised cause, namely, an excess of albuminous food, of meat in particular. Rheumatism, of either the acute or chronic form, is very uncommon amongst moderate eaters and vegetarians; and threatening attacks may often be warded off by a temporary recourse to the latter dietetic system.

(*c*) *Hereditary tendency*, that is to say, a weakness in the act of tertiary digestion, acquired from the parents, and due to a defect in the ovum from which the individual was developed.

(*d*) *Loss of power in the nervous system.* In all fevers, transient rheumatism is, as most people know, a marked and early symptom.

Such are the *causes* of rheumatism. Neither damp, nor cold, nor worry, nor other depressing influence, can be ranked as causes. They are merely the developers of the already present, though undemonstrative, disease. They supply, so to speak, the necessary conditions for the growth of the plant, but they do not supply the seeds, the *real cause* of the result produced. Most of us have the seeds of rheumatism or gout in our bodies. Want of exercise—in other words, deficient pumping out of waste; worry and anxiety—in other words, nerve weakness; the over-consumption of albuminous food—in other words, digestive failure on the part of the cells; old age, the result of mere lapse of time or of the premature decay of a still young body; hereditary tendency; such are the real causes. Some one or more of the above agencies are at work in most of us, and are producing or have produced the poison; but as long as our skins and kidneys are working well, we may not, we probably shall not, become aware of our danger. Let the action of either be suddenly arrested—and a damp bed, residence in a badly-built house, exposure to a damp-laden atmosphere, or the leaving off of flannel under-clothing will suffice—and the enemy will be upon us.

But besides the effect of an arrested action of the skin, with the consequent increased blood-supply to the muscles, and the decreased elimination of waste, acting as exhibitors of our rheumatic state, we may have an equal result produced, provided the poison be in our system, by any sharp depression of the nervous system, as by domestic bereavement, etc., or by any derangement of the kidneys. Of course the more uric acid an individual is charged with, the *less* in weight will be that *last straw* which suffices to bring him to the ground.

To many of my readers such views may be novel, but the tendency of research is every day adding to the weight of evidence in their favour. For every physical result, such as disease, there is, there must be, an adequate physical cause. This may not always be easy to trace, but it is, nevertheless, the *sole* factor at work. Disease is, no doubt, as everything else is, the act of God; but he evidences His presence by certain laws, to which we give the name of Nature; and infraction of those laws, and *that alone*, leads to derangement of our bodies; which derangement again, after putting us to some painful experience, always conducts us, unless decay and degeneration have set in, back again to equilibrium and health.

How, then, is such a disease as rheumatism to be avoided?

simply by leading a healthy life and obeying the laws of nature. There is no royal road to health, any more than there is to knowledge.

Regulate dietary, and practise abstemiousness, especially in the use of meat. Avoid alcohol, especially such forms of it as heavy malt liquors and sweet wines, which are great embarrassers of the digestive process. Let exercise be taken in abundance.

Medicinal treatment.—That of the acute form, the so-called rheumatic fever, I shall not refer to; because I presume that the reader will, very properly, summon medical counsel directly he is attacked with so violent a disorder; and because my views as to the measures to be adopted are at variance with those that are at present popular with the profession.

In the chronic form, a treatment on the whole very similar to that in chronic gout is advisable. Combinations of iodide of potassium, especially with chloride of ammonium, for which I have given a formula, are often useful. Bicarbonate of potassium is also not unfrequently of service. Guiacum, from its special power on the skin, and arsenic, from its power over the vaso-motor nerves, are both very favourite medicines in the chronic forms of rheumatism, and to adults may be administered together as follows:—

Arsenious acid, 1 grain; powdered guiacum, 2 drs.; oil of cassia, 6 drops; compound rhubarb pill, 1½ drs. To be divided into 60 pills. One pill to be taken after food, two or three times a day.

All medicinal treatment must, however, be quite secondary and subsidiary to hygienic measures, or it will utterly fail to do any *permanent* good.

With a final tabular review of the whole digestive process, I will now conclude this part of the book. Let me finally impress, what I have endeavoured to inculcate throughout, that in the comprehension of the natural laws which rule and guide the body, from the most complex of the brain cells to the least important of those inorganic substances which result from the final digestion of the food, lies the only sure path to a happy and a long life. Every deviation therefrom brings inexorably its punishment, though such punishment is indeed but the goad wherewith man is driven back to the right path, for the laws of disease are identical with, not antagonistic to, those of health.

(Insoluble) *Starch*, acted on by a diastatic ferment (ptyalin) in the mouth becomes ... ...
Acted on by a diastatic ferment (amylopsin) in pancreatic fluid, becomes ... ...
Grape sugar (soluble.)

The soluble grape sugar passes by portal vein to the liver, where it is re-converted to animal *starch* (glycogen) and thus, being rendered again insoluble, is stored.

It is acted on gradually by a diastatic ferment in the blood from the hepatic artery which flows through the liver, and is slowly converted again into *grape sugar* (soluble).

This grape sugar, passing to tissues, is burnt up by virtue of the oxygen in the blood, and

becomes
Carbonic acid, excreted by lungs and skin.
Water, excreted by lungs, skin, and kidney.

Result.—Starch supplies heat energy, and sometimes fat (reserve).

(Insoluble) *Fat*, acted on by emulsin in bile, is converted to an ... ...
Acted on by emulsin in pancreatic fluid, becomes an ... ...
Emulsion (soluble).

Acted on by steapsin in pancreatic fluid becomes...
Fatty acids (soluble).
Glycerine (soluble).

Both the emulsion and the products, resulting from the action of steapsin, pass to the thoracic duct, thence to the general circulation and the tissues, and by virtue of the oxygen in the blood, are consumed,

and become
Carbonic acid, excreted as above.
Water, excreted as above.

Result.—Fat supplies heat energy, and sometimes reserve fat.

(Insoluble) *Albumen*, acted on by pepsin and acid in stomach, becomes ... ... Acted on by trypsin in pancreatic fluid, becomes	Soluble albumen (peptone).
Soluble albumen, or peptone, travels by portal vein to liver, and is there divided into	Serum albumen for blood. Bile acids, urea, etc.

The serum albumen goes to tissues, is split up, part going to repair the body cells; the remainder, known as amides, amines, and amido-acids, is converted to urea.

The urea from the liver and from the tissues is excreted by the *kidneys* mainly. When in place of urea much uric acid is formed, gout and rheumatism result. Bright's disease often follows the irritating effect on the kidneys of this acid.

Result. Albumen supplies repair material, (some heat-energy and some fat).

Salts assist the digestion of albumens, and help to form bile.

PART II.

CHAPTER XIV.

FOODS.

Nothing is more difficult than to give a typical dietary possessed of any real value or correctness. It is true that physiology tells us, as a result of her investigations, what are the minimum amounts of food on which the convict can exist when at hard labour or in solitary confinement. The military hygienist gives us his experiences and his reasons for coming to certain conclusions as to the needs of soldiers, in peace and war. The analytical chemist deftly takes to pieces the various articles on which we depend for nourishment, and tells us what their per-centage composition is. Notwithstanding such assistance, the practical physician finds that he has very largely to depend upon his own judgment and to use his own discretion in his dietetic recommendations to suffering humanity. He finds that individuals differ in structure, in habits, in means, in age, in their standards of attainable health, in their surroundings, and finally in their idiosyncrasies, and that, if he would avoid failure, and indeed ridicule, he must make due allowance for such of these as may be present.

In dealing with the question of foods, I shall therefore not aim at precision in the amounts of food necessary at each individual meal, but shall first of all show the reader what have proved themselves to be efficient quantities of food in a large number of individual cases, and then give the results of the analysis of certain familiar articles of diet.

The following is the *mean* of several tables by Drs. Parkes, Davy, Playfair, von Pettenkofer and von Voit.

PER DAY.

	Albumens.	*Fats.*	*Starches* (including sugars).
Child up to 18 months	$1\frac{1}{4}$ to $2\frac{1}{2}$ oz.	2 to 3 oz.	$3\frac{3}{4}$ to $5\frac{3}{4}$ oz.
,, 6 to 15 years	$4\frac{1}{2}$ to 5 oz.	$2\frac{1}{4}$ to $3\frac{1}{2}$ oz.	$15\frac{1}{2}$ to 25 oz.
Man (moderate work)	6 to 8 oz.	$3\frac{1}{2}$ to 5 ,,	31 oz.
Woman	5 to 6 ,,	$2\frac{3}{4}$ to $3\frac{3}{4}$,,	25 ,,
Old man	5 to 6 ,,	4 to 5 oz.	$21\frac{1}{2}$,,
Old woman	$3\frac{3}{4}$ to 4 oz.	$3\frac{3}{4}$ to $4\frac{1}{2}$ oz.	$15\frac{1}{2}$,,

The above table may be said to represent a minimum diet, and is calculated *for foods as they are bought*, not, as in ordinary tables, for water-free solids.

The proportions to each other, of the three classes of food are, therefore, roughly, albumen 1, fats $\frac{1}{2}$, starches 3, in adult life.

The table I have just given is, as I have stated, a mean of several tables which differ widely, some excellent observers giving the minimum amounts at *least one third* higher than do others.

The fats can, and in the dietary of some races do, replace the starches. The dietetic value of fat, weight for weight, is higher than that of starch, in the ratio of 175 to 100. Thus, a man doing ordinary work requires—

Either 6 oz. of albumen, $3\frac{1}{2}$ to 5 oz. of fat and 31 oz. of starchy food,
or 6 oz. ,, ,, 21 to 23 oz. of fat, and no starches,
or 6 oz. ,, ,, no fats, and 37 to 40 oz. of starchy food.

He *must*, however, have the nitrogenous food or albumen. Nothing can replace that; neither the fats nor the starches are in any sense its equivalents.

In some races of mankind, such a substitution of fat for starch or starch for fat, in the daily consumption of food actually takes place, and from a scientific point of view, such interchange is thoroughly compatible with what we know of the needs of the human body; but individual experience, and the tendency of the vast majority of mankind to partake of the three forms of food, when they are procurable, rather than to restrict themselves to the two, render it probable that a due admixture of the three forms is most conducive to our bodily requirements.

We have thus a general idea of the daily needs of the body, and

I will now show what are the proportions of the three groups of food in the common articles of diet. We shall then be easily able to calculate the amount of food necessary for a healthy child, or for a middle-aged, or an old, man or woman, always keeping well in mind the fact that such a dietary can have but the value of a *general basis*, and not of a fixed standard, and must be modified according to individual circumstances.

With regard to water and to salts I have said nothing. The *natural* demand for both may be looked on as a sure guide.

TABLE OF PER-CENTAGE COMPOSITION OF FOODS.

A—THE MEATS.

Foods.	Albumen (Nitrogenous Material). Per cent.	Starches (Sugars) (Corbohydrates). Per cent.	Fats (Hydrocarbons). Per cent.
Fat Beef	15	0	30
Lean Beef	20	0	4
Fat Mutton	12	0	31
Lean Mutton	18	0	5
Fat Pork	10	0	49
Green Bacon	7	0	67
Dry "	9	0	73
Veal	17	0	16
Ox Liver	19	0	4
Tripe	23	0	17
Poultry	21	0	4
Sheeps' Kidneys	17	0	2
Salmon	16	0	5
Eels	13	0	24
Mackerel	13	0	12
Herring	10	0	7
Oysters	14	0 (?)	1½
Mussels	11	0 (?)	2
Plaice, Whiting, Turbot (& White Fish generally)	18	0	3
Entire Egg	13	0	16
White of Egg	12	0	2
Yolk of Egg	15	0	30
Cream Cheese	7	0	30
Whole Milk Cheese	28	0	21
Skim Milk Cheese	32	0	8

The balance of the composition in each case is made up of water, and of from three to five per cent. of salts.

NOTE.—The above foods are all devoid of starch or sugar, hence they are not unfrequently spoken of as "*the* nitrogenous" foods. This is incorrect, for, as we shall see, the milks and seeds contain also much nitrogen.

B—THE MILKS.

FOODS.	ALBUMEN (Nitrogenous Material). Per cent.	STARCHES (sugars) (Carbohydrates). As sugar of milk. Per cent.	FATS. (Hydrocarbons). Per cent.
Cows' Milk	4	5	4 to 5
Asses' Milk	2	5	1
Goats' Milk	3·7	4	4 to 6
Mares' Milk	2	4	1½
Human Milk	3	6	3
		As cane sugar, &c.	
Condensed Milk	18	42	11
,, ,, diluted	3	9	2
		As sugar of milk.	
Skim Milk	4	5	½ to 2
Butter Milk	4	6	½
Koumiss	4	6	1
Cream	3	3	30
Whey	traces	5	1
Frankland's Artificial Milk	3	6	3 to 4

The balance of the per-centage consists of water and 1 to 2 per cent. of salts.

C—THE SEEDS AND THEIR DERIVATIVES (VEGETABLE KINGDOM.)

FOODS.	ALBUMEN. Per cent.	STARCHES. Per cent.	FATS. Per cent.	
Peas	23	57	2	
Lentils	24	50	2	
Haricot Beans	23	52	2	
Broad Beans	29	56	2	
Wheat Meal	11	74	2	
Barley Meal	8	72	2	
Oatmeal	13	64	8	
Rye Meal	9	71	2	
Maize Meal	10	65	7	
White Bread	4	52	1½	
Whitemeal Bread	10	56	1½	
Biscuit	15½	73	1	
Rice	6	83	1	
Cocoa Nut	5	8	36	The oily seeds.
Almond	10	9	30	
Walnut	12	9	31	
Hazel Nut	8	11	28	
Brazil Nut	8	8	42	
Green Almond	9	10	33	

The balance, as before, consists of water and from 1 to 5 per cent. of salts.

D—PORTIONS OF PLANTS (NOT SEEDS.)

FOODS.	ALBUMENS. (Nitrogenous Material.) Per cent.	STARCHES (sugar.) (Corbohydrates.) Per cent.	FATS. (Hydrocarbons.) Per cent.
Potatoes	2	22	½
Jerusalem Artichokes	2	14	1½
Carrots	1½	15	¼
Parsnips	1	15	½
Beetroot	1½	13	0
Turnips	1	7	0
Cabbages	2	6	0
Onions	1½	5	0
Radishes	½	1	0
Seakale	2½	3	0
Celery	1	4	0
Mushrooms	5	4	½
Lettuce	1	1	traces
Watercress	2	3	,,
Vegetable Marrow	½	2	¼
Cucumber	¼	2	0
Tomatoes	1	8	0
Apples	½	12	1
Pears	½	11	traces
Gooseberries	½	8	1
Grapes	½	16	1
Strawberries and Currants	1	16	1½
Cherries and Plums	½	11	1
Figs	6	66	1
Dates	6½	66	¼

Balance as before.

E—EXTRACTS DERIVED FROM PLANTS.

FOODS.	ALBUMENS. (Nitrogenous Material.) Per cent.	STARCHES (sugars.) (Carbohydrates.) Per cent.	FATS. (Hydrocarbons. Per cent.
Arrowroot	0	82	0
Sago	0	77	0
Tapioca	0	79	0
Sugar	0	95	0
Treacle	0	77	0

Balance, water and salts.

Now, there are certain peculiarities of these different groups that strike us at once.

The Meats contain no starch, and, except in the case of very fat meats, such as bacon, it is clear that they do not fulfil the conditions necessary for ordinary diet, viz., 1 part of albumen to 3½ of non-nitrogenous materials.

The *milks* approximate much more closely than the meats, or indeed, than any other group, to the physiological proportions. I refer, of course, to the milks proper, not to cream, whey, etc.

The *vegetable seeds*, containing as they do all the necessaries for the early growth of the plant, come, many of them, pretty close to ideal human requirements, closer than, indeed, they appear at first sight to do, for from one fifth to one-sixth of their starch is in the form of cellulose and lignose (woody fibre), and in these forms is insusceptible of digestion by the human stomach.

The *fruits and vegetables* can, evidently, from their per-centage composition, form but adjuncts to other foods. Figs and dates, however, stand out in sharp contrast to the rest, being rich in sugar. The water and salts that are contained largely in fruits, render them, however, as foods, of very high and special value.

I will now consider the foods singly, keeping still to the same five divisions of food, and rapidly run through the names of the sources whence they are derived, throwing out in passing, such hints as I think may prove useful to the reader.

FOODS DERIVED FROM ANIMAL KINGDOM.—(A.) THE MEATS.

Meat. General principles.—The qualities of meat are modified by the following conditions :—

(*a*) *Age.*—The flesh of young animals is more gelatinous and more tender than that derived from mature ones. It is, however, less stimulating, less nourishing, and, as a rule, less digestible. Beef is at perfection at four years, mutton at three years.

(*b*) *Sex.*—The female is, as a rule, the more delicate and tender—spaying further improves the flesh. Unsexed male animals, as the ox and capon, are less delicate than unsexed females, but still far superior to the male, whose meat, during the period of sexual activity, is coarse and rank.

(*c*) *Size.*—The smaller breeds are, as a rule, superior in fineness of grain to the larger. This applies as much to different animals as to breeds.

(*d*) *Season.*—Beef and mutton are never actually out of season, but are best during autumn, when the animals have enjoyed a good supply of summer food. Pork is in season in winter, as also is doe venison, but buck venison is best from June to September, when rutting season commences.

(*e*) *Mode of life.*—By stall feeding beasts gain in fat, but lose in flavour. The flesh of wild animals has less fat, but is higher in colour and finer in flavour than that of domesticated ones.

(*f*) *Food.*—Oxen fed on oil-cake have a peculiarly soft yellow fat. Turnips flavour the flesh of sheep. The short mountain grass imparts to the flesh of the same animal a special flavour, which is highly appreciated by connoisseurs.

(*g*) *Mode of death.*—The complete draining away of the blood of the slaughtered animal, as is the custom with butchers who supply the Jews, renders the meat more pleasant to the eye, makes it keep longer, and improves its flavour. It also reduces the slight risk which the eater runs of acquiring any disease which the animal may have had at its death.

Keeping after death improves digestibility by rendering meat *softer.* But if fresh meat be eaten within a few hours of its being killed and before stiffening (post-mortem rigidity) has set in, it is as soft and digestible as meat which has been kept till that condition has passed off. *Wholesome meat* (according to Dr. Letheby) has the following characteristics:—" 1. It is neither of a pale pink colour nor of a deep purple tint, for the former is a sign of disease, and the latter indicates that the animal has not been slaughtered, but has died with the blood in it, or has suffered from acute fever. 2. It has a marbled appearance, from the ramifications of little veins of fat among the muscles. 3. It should be firm and elastic to the touch, and should scarcely moisten the fingers, bad meat being wet, sodden, and flabby, with the fat looking like jelly or wet parchment. 4. It should have little or no odour, and the odour should not be disagreeable, for diseased meat has a sickly cadaverous smell, and sometimes a smell of physic. This becomes apparent when the meat is hopped up and drenched with warm water. 5. It should not shrink or waste much in cooking. 6. It should not run to water nor become very wet on standing for a day or so, but should, on the contrary, be dry upon the surface. To this it may be added, that there should be no sign of the presence of parasites. The fat also should neither be deficient nor excessive. To assist in judging of the freshness of meat, a clean knife may be passed into it and applied to the nose on withdrawal. In this way the condition of the centre may be ascertained."

Pork from the *domestic* pig is, on account of its large per-centage of somewhat unstable fat, indigestible. The fibres of the flesh are also somewhat close. When kept, however, and eaten as bacon, it is highly nutritious and much more digestible. The large per-centage of fat which it contains renders it, from a gastronomic and scientific point of view, a useful adjunct to lean meats, such as poultry, rabbit, and veal, and to other nitrogenous foods, such as beans and peas, not rich in fat.

Beef, and the flesh of the wild boar, stand on a par, as far as digestibility is concerned. They are excellent meats for the robust, but are apt to prove troublesome to weak stomachs.

Mutton contains a finer grain, and is more suitable than the last mentioned for the weak and dyspeptic.

Venison, as far as tenderness is concerned, is on a par with mutton, but its richness and high flavour render it less digestible.

Veal and lamb, like the flesh of young animals generally, are not so digestible as the meat of older animals of the same species, though they are superior in tenderness. The amount of gelatine present in them is supposed, but on doubtful grounds, to be the cause of the relative difference.

Pheasants, partridges, quail, snipe, woodcock, and tame pigeons are, if well kept, tender and digestible, and on account of their flavour, tempting to invalids, with whom they mostly agree well, being better borne by the stomach than poultry or meat.

Of domestic poultry, chicken, guinea fowl, and turkeys are, on account of the looseness of the muscular fibre and the freedom from fat, easy of digestion. Ducks and geese, which contain a large amount of the latter ingredient, are not so suited for delicate persons. Wild aquatic birds are also indigestible.

The rabbit is, owing to the closeness of its muscular fibres, inferior to poultry in digestibility. The same remark applies to the flesh of the hare, which is further rendered an ineligible candidate for the dyspeptic stomach by its abundant flavour.

Of the relative digestibility of different parts of animals it may be laid down that—

Tripe is nourishing, but somewhat rich, otherwise easy of digestion.

Sweetbread is digestible, if plainly cooked. Its richness may be covered by admixture with lean meat.

Kidney, if lightly cooked, is digestible.

Heart, on account of the closeness of its fibres, is tough and indigestible.

Bones, if broken up and boiled for some hours, contain a large amount of nutrient matter.

FISH forms the second great class of nitrogenous animal foods. It does not possess the invigorating and satisfying properties of meat. On account of its poorness in fat, and of the easy separability of its fibres, it is, however, in the vast majority of cases, more easy of digestion and assimilation than meat.

White fish, such as whiting, haddock, sole, turbot, brill, plaice, flounder, etc., stand high as foods in dyspepsia, and rank, in digestibility, according as their flesh is soft and tender, or arranged in firm flakes. The cod, for example, whose flesh is very firm when it is in season, is by no means always well borne by the stomach.

Red-fleshed fishes—salmon, etc., are suited only for robust stomachs.

Smoked, dried, pickled or salted fishes are indigestible.

The *oily fishes*—mackerel, herring, sprats, etc., though highly nutritious, are less digestible than the *white* ones.

The flavour of fish is influenced very largely by its food and the condition of the water in which it lives. Fresh-water fish from pools or streams with a sandy and gravelly bottom, are better than those from muddy streams. Lochfine herrings and Finnan haddocks are, with good reason, more highly esteemed than fish of the same kind captured elsewhere. Fresh-water fish should be eaten when quite fresh, and so should, as a rule, be salt-water fish, but, in regard to the latter, there are some exceptions, notably in the case of turbot, which improves by keeping. Fish are at their best just before spawning. During that process they became thin, and are said to be out of season. Contrary to the general belief, the process of spawning does not render them indigestible as food.

Shell fish are divided into two classes :—

(1) The *crustaceans*—lobster, crawfish, crab, prawn and shrimp. These are suited only for strong digestions.

(2) The *molluscs,* which comprise the oyster, the mussel, the scallop, the cockle, the periwinkle, the whelk, and the limpet.

Oysters are very digestible if *eaten raw.* Consisting as they do very largely of liver, which contains glycogen and the diastatic ferment for the conversion of it to digestible sugar, a mere crushing between the teeth is all that is necessary to at once place a large part of the oyster beyond the need of further digestion. Cooking, by destroying the ferment and rendering the body of the oyster hard, reverses the state of matters.

Mussels, which are rarely eaten raw, are indigestible. Under certain conditions they produce in the consumer violent choleraic symptoms accompanied often by nettlerash. It was formerly supposed that mussels which produced such symptoms, had been adhering to the copper bottoms of ships and that the poisoning was the result of a salt of copper absorbed by the fish. The similarity between the symptoms present and those of copper poisoning lent colour to the theory, which, however, thanks to the researches of a German scientist, has now been disproved. He has shown that certain varieties of the shell fish develop normally in their tissues a poison belonging to the class of ptomaïnes (the name by which a class of poisons, the result of the decomposition of albumen, is known), and that to this poison the symptoms are entirely owing.

Eggs, like milk, constitute in themselves a perfect food for man, the proportions, however, in which the various constituents are blended are not so suitable as in milk ; and, if we desired to sustain life *solely* on eggs we should have to consume a portion of the shell. Though eggs agree with the majority of mankind, there is no other common article of food in the consumption of which individual idiosyncrasy is so marked. In some the eating of eggs is followed by severe symptoms, like those produced by tainted meat; in others, discomfort referred to the stomach and liver, und usually described as biliousness, is experienced. These bilious symptoms are occasionally accompanied by jaundice. In certain diseases, notably in acute rheumatism and gout, the latter of which, be it remembered, is largely dependent upon liver derangement, eggs retard recovery, and will in some individuals produce relapse. They rarely agree in typhoid fever.

The various methods of keeping eggs are all founded on the principle of excluding the entrance of air through the pores of the shell; therefore smearing with lard or coating with gum are common procedures. Many excellent egg-testers are sold, but the following is an easy test of the age of eggs: 2-oz. of salt to a pint of water *just* allows a fresh egg to sink. Eggs a week old will float in it. Eggs still more stale will float in water containing but half the relative amount of salt. Eggs quite unfit for food, will float in plain water.

Eggs form a useful addition to milk puddings, but as egg albumen has a tendency to *mat together* the different starch grains of which an ordinary milk pudding consists, they have a tendency to render the pudding trying for weak stomachs. In the latter case, eggs should be omitted, or only the *yolks* used.

(B.)—MILK.

Is in itself a perfect and sufficient food for all ages. On account of its high percentage of water, it might seem, on analysis, to be poor, in comparison with most foods—in fat, sugars, and albumen; but when the *amount* of it consumed at one time is considered, this apparent poorness disappears. The quality of milk, as is well-known, is influenced by pasturage, by the length of time after calving, and by the breed of the cow. The most effective way of testing milk is by the lactoscope—a simple appliance, in the use of which, with a little practice, anyone may easily become an adept. Two other methods are useful for determinining its quality in a rough and ready manner. First skim the milk (for excess of cream equally with excess of water owers the specific gravity), then add a few drops of vinegar to curdle the milk, strain off the whey, and take the specific gravity, of the latter with the lactometer.

If pure, a spec. grav. of 1029 will be registered by the lactometer
If 10 p.c. added water, 1025 ,, ,, ,,
20 ,, 1022 ,, ,, ,,
30 ,, 1020 ,, ,, ,,
40 ,, 1017 ,, ,, ,,
50 ,, 1014 ,, ,, ,,

To estimate the amount of cream, a second sample of the milk is placed on a tall, thin, graduated glass, on which the percentage of cream may easily be read off.

A second plan is to place a sixpence at the bottom of each of two tumblers, then pour an exactly equal quantity of pure water into each tumbler, then add twenty drops of one sample of milk to the one, and twenty drops of a second sample to the other, stirring both well. The tumbler in which the sixpence at the bottom can be seen most plainly contains the poorer sample of milk.

Whole milk is nourishing, and a well-adjusted food for infants and young children, and a good beverage-food for adults.

Skim milk is simply whole milk, from which a varying amount of cream has been taken. Formerly, as much as two per cent. of cream was left, but now, by the process in use in large dairies, it is much more completely removed. The skimming, compared with the old manual methods, is effected rapidly, and the resulting skim milk is sweet and may be very advantageously employed in the making of soups, puddings, and junkets. Its cost is about 6d. per gallon.

The old method of separating the cream by hand necessitated the prior keeping of the milk for twelve to twenty-four hours, with the result that the skim milk was usually sour. It was none the less digestible on that account, but was unpalatable to many people.

There are several ways of rendering whole milk digestible. 1. *Boiling* prevents the formation of a large hard curd. 2. *Adding some farinaceous substance*, as powdered biscuit, effects the same purpose. 3. *Peptonising* or Pancreatising it, by means of suitable powders. 4. *Humanising* it. The Aylesbury, and many of the large London dairies prepare artificial human milk, made from that of the cow. The price is high, and for poor persons prohibitive. I will, therefore, give Frankland's method, which is simple and easy.

Take half a pint of new milk, and let it stand for about *twelve* hours. Then skim off the cream and add the cream to a pint of perfectly fresh milk. To the half-pint of skim milk add a piece of rennet about an inch square, and let the vessel containing it stand in hot water till the milk has thoroughly curdled.* Remove all the curd. To the remaining whey add a little powdered white sugar, warm it, and then pour it into the pint of new milk to which the cream has been already added. No dilution is necessary in the use of this milk for infants.

Whey forms an excellent drink. It is rich in salts, which impart to it valuable dietetic properties.

Buttermilk is a bye-product in the manufacture of butter. Like skim milk, it contains little fat. From the length of time that the cream requires to be kept, buttermilk is of necessity a little sour, but this very sourness renders it more digestible, the albumen (casein) which it contains being in a partly disintegrated state. It is a slight laxative, and is supposed to have a beneficial effect on a torpid liver. It is easily borne by the stomach, and is an excellent food in acute or chronic inflammatory dyspepsia, in Bright's disease, and in diabetes.

Koumiss is produced by the fermentation of milk, the result of which is that all the sugar becomes converted into lactic and carbonic acids, and that the casein (or a portion of it) becomes coagulated in a finely flocculent condition. The digestibility of koumiss is further increased by keeping, the lactic acid slowly acting on the casein till this at last is completely dissolved, the result being that no curd forms in the stomach. The fact that it is also acid and effervescent renders it tolerable to feeble stomachs. Koumiss varies with age. That recently made is somewhat laxative. The older possesses, on the other hand, mildly astringent properties. In Germany and Russia a preparation of milk, resembling koumiss, and called Kefr, is largely used.

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* As soon as the curdling commences, the rennet should be removed and put aside in an egg cup for future use, as it can be employed daily for a month.

Ways of preserving milk.—As is well known, cows' milk, especially in warm weather, becomes so rapidly acid that, while this acidity is still too feeble to be detected by the taste, it will cause curdling directly the milk is heated. The best way to preserve milk is to scald it while still fresh. Another harmless method is, to add a teaspoonful of bicarbonate of soda to each gallon of fresh milk. Boracic and salicylic acids, which are frequently used for the purposes of preservation, are, in many ways, objectionable.

I append two economical methods of using milk and cheese in soups:—

1. Take two pounds of potatoes, clean and peel them, and cut them into small pieces, and place in a saucepan with enough water to cover them. Add two or three leeks or onions, finely sliced, and heat the whole to boiling, after which it should be put to simmer until the vegetables are cooked to a mash, when the mash should be worked through a fine wire sieve. What passes through the sieve should then be returned to the saucepan, a pint of skim milk added to it, with pepper and salt to taste, and the whole brought to the boil. When it boils, two or three table-spoonsful of crushed semolina or tapioca, sago, corn flour, etc., should be added *gradually*, the whole being well stirred whilst doing so. Boil for a quarter of an hour and serve with bread or toast. The result will be a very palatable and nutritious soup, the flavour and precise composition of which may be varied in several ways, so as to afford variety.

2. Take an ounce of any cheese, and work it through a wire sieve of medium mesh. Place the resulting mass in a basin with a little skim milk, and work the whole with a spoon till all lumps have disappeared. This process will be rendered easier by placing the basin in *warm water* (not hot water, which might curd the milk and spoil the process). Then take half of the total amount of skim milk that you intend to use, and mix with it three dessert-spoonsful of corn flour. Boil the remaining half of the skim milk, and, when at the boil, place in it two or three onions, finely cut up, leaving it to simmer till the onions are quite cooked, when it should be strained, put back in the saucepan on the fire, and the cold milk, with the corn flour in it, should be gradually

added, stirring well whilst doing it. As soon as the whole has been well mixed, take it off the fire and add it, spoonful or cupful at a time, and very slowly, to the cheese mixture, stirring the latter well whilst doing so. As soon as the cheese mixture has been thus made warm and into a thick paste, it may slowly be poured into the saucepan and well mixed by stirring. Then reheat the whole lot, adding enough milk to make it thin enough. Put in salt and pepper, etc., to taste.

Butter, if fresh, is one of the most easily digested fats. Badly-made butter, *i..e*, that containing small curds, will not keep long; the curd rapidly decomposing and setting free the fatty acids.

Cheese is made from the curd of milk, and is therefore very rich in nitrogen, though a certain amount of the fatty matter in the milk is also retained. In the richest cheeses, such as Stilton and Double Gloucester, cream is added to the milk before the cheese is made. Cheshire cheese is made from unskimmed milk, Single Gloucester, Chester and American cheese, with milk from which some of the cream has been removed. Dutch, Parmesan, Suffolk, and Somersetshire cheese are from skimmed milk. Cream cheese is simply the fresh curd of milk, slightly salted and moderately pressed.

(C.)—FOODS DERIVED FROM THE SEEDS OF MEMBERS OF THE VEGETABLE KINGDOM.

Consisting as they do of all the materials necessary for the subsequent growth of the perfect plant, seeds contain, as we should expect, a mixture of all the great necessary elements of nutrition, and it is from them that the most important and most digestible of our food stuffs are drawn.

1. *Wheat.*—Of this there are several kinds in the market, the variety depending on difference of plant, soil, and climate. Hard wheat, grown principally in South European countries, is used largely in the manufacture of macaroni. Soft wheat thrives best in northern climates. The entire grain is rarely used now as food. Formerly it was boiled in milk, and formed a popular dish called frumenty. The entire grain, when ground, is called *meal*. It is from this substance that wholemeal bread is made. This meal is

rich in nitrogenous material, of which it contains from ten to fourteen per cent. For the making of white bread, the meal, after being ground, is separated into three parts—flour, pollard and bran. It is from the flour, which consists almost wholly of starch, that white bread is made. The pollard and bran, which contain nearly all the nitrogenous material in wheat, are usually sold as food for the lower animals. The following very digestible articles are made from white flour: toast, biscuits, rusks, pulled bread, vermicelli, macaroni, and semolina—the last three from *hard* wheat flour. Wholemeal bread, containing as it does all the three necessary constituents of food, is, as an article of diet, far superior to white bread. As an economical food it ranks high, and should be consumed in place of white bread by the children of our poor. Strange to say, it is, however, the rich who are its great patrons. Such people would do better on white bread. In England the wheatmeal is *very badly ground*, the crust, therefore, becomes in baking soon hard, and offers so much resistance to the heat that the interior of the loaf is badly baked, whilst the exterior is of the consistence of wood. For this reason, the smaller flat loaves of wholemeal bread are to be preferred. Ærated bread, prepared after Dr. Dauglish's method, is light, and easy of digestion. It, however, does not possess any higher or different nutritive properties than those existent in ordinary white bread.

Oats, as met with in commerce, consist of grain and husk. The separated grain is called groats or grits. Oatmeal is produced by grinding the groats. On account of the absence of gluten, oatmeal cannot be made into bread, as it lacks tenacity. Mixed with water it is, however, made into thin brittle cakes, much esteemed in Scotland. Oatmeal is even a more nutritious food than whole wheat meal, being richer in nitrogenous food and in fat than the former, which it further excels in cheapness. It contains a considerable amount of phosphate of lime, and for that reason is recommended in rickets and bone diseases in which the bones are wanting in that salt. Oatmeal eaten with whole or skim milk forms a perfect food, and is the mainstay of the peasantry in Scotland. It is probably to a very large extent due to the consumption of such an easily digestible vegetable food that the Scotch enjoy their freedom from gout. Heartburn and waterbrash seem in some people to follow the consumption of oatmeal. The husks of oatmeal are sometimes fermented with water, and used as food. The product is sourish in taste, and does not recommend itself on a first acquaintance, but is highly digestible and very suitable as an occasional dish in dyspepsia. Oatmeal is sometimes stirred into the hot liquor in which beef or cabbage has been boiled. The mixture receives the name of Brose.

Barley.—When ground, barley is called barley meal. Being, like oatmeal, devoid of gluten, it cannot be made into bread, but is used mainly as a thickening for soups.

Malt is barley that has been allowed to sprout, and the sprouting of which has then been arrested by the heat of a kiln. As a result of this process, an active ferment (identical with the ptyalin of the saliva and the amylopsin of the pancreatic juice) is produced, which, at a certain temperature (that about 140° Fahr. is the best) has the power of converting starch into grape sugar (and dextrine). The altered barley grain, when ground, is called malt flour, and forms a very useful addition to the food of invalids, in whom there is reason to think that the salivary and pancreatic digestions are defective. It also enters largely into the composition of patent foods, for use in early infancy. In such combinations the malt forms a substitute for the ptyalin, which is very deficient (not absent, as incorrectly laid down) in infant saliva. Occasionally such foods may be highly commended as substitutes for milk, but as a rule it may be said that they should be avoided, if it be possible, in the first nine months of life. It is most important to remember that boiling destroys the action of malt (as of every ferment), and that therefore malted invalids' and infants' foods should not be subjected to it until they have been exposed for some time (twenty minutes or so) to a moderate heat such as that of hot water in which it is possible to keep the finger.

Rye, ground into ryemeal, is used extensively in North Europe. The bread made from it is brown or black, and somewhat acid. It is therefore apt to set up diarrhœa in persons unaccustomed to eat it.

Maize, or Indian corn, is an article of very high nutritive value, in fact, among the cereals it stands pre-eminent. Ground into flour of various degrees of fineness, it is called maize meal, or more commonly, hominy. Being, like oats and barley, poor in gluten, it is not suitable for the making of bread, but is, on that very account, better than flour in invalid cookery, the adhesiveness peculiar to gluten causing, when cooked, a binding together of the flour particles, which renders their digestion more difficult than that of the grains of maize meal. Plain maize meal has a peculiarly harsh and unpleasant flavour, for the removal of which it is subjected to various processes. The treatment of it by a sweet solution of caustic soda is one of the most efficient plans. The meal, however, loses by this treatment, some of its nutritive value. In this way, subject to slight variations in each case, our familiar Oswego flour, Corn flour, and Maizena are prepared. In America the preparations of maize meal are held in high repute as dietetic adjuncts, especially to the breakfast table. Johnny cake, Hoe cake, and Indian cake are prepared from it. In Ireland and in Italy it is also much used, the Italian national dish, Polenta, being a porridge in which maize meal is the main ingredient.

Rice, like maize, being poor in gluten, cannot conveniently be made into bread. Compared with other meals it is poor in albumen and fats, but rich in starch, for the production of which it is largely used in commerce. It forms a very useful vegetable ; its starch granules being more digestible than those of the potato, it may with convenience be used by dyspeptics as a substitute for that tuber. It is ground into rice meal, and is thus extensively used as an addition to wheat flour, in the making of some breads, to which it imparts whiteness and digestibility.

Buck-wheat is not a cereal, but the seed of a plant of the order Polygonaceæ. In France it is called *Blé Sarrasin*, in Norfolk it is known as " brank." In England it is mainly used as nourishment for poultry or game, and sometimes as a substitute for oats in horses' food. Ground, it forms an excellent white meal, but this, from its deficiency in gluten, cannot be conveniently made into bread. In the United States it is used for the making of cakes and pastry, which it renders light and digestible. In Holland a kind of crumpet is made with it.

Quinoa, the seed of Chenopodium Quinoa, a native of Chili and Peru, forms, among the poor of those countries, a staple article of food. It is almost of equal nourishing power with maize, and possesses the peculiarity of being, of all known seeds, the richest in iron. It is exceptionally digestible.

We now pass to the pulses, or leguminous seeds.

Peas and *Beans* are very rich in albumen, and, in a vegetarian dietary, efficiently replace meat. On account of this preponderance of nitrogenous material (an albumen called Legumin) they form suitable additions to foods rich in starch and fat. Thus the popular dish of beans and fat bacon is an excellent combination. Peas and beans are, however, somewhat difficult of digestion, and require a large amount of previous soaking and careful cooking to render them soft. They are considered heating, and are in consequence used as additions to the winter food of horses and cattle. Broad beans, haricot beans, fresh and dried peas, and Egyptian lentils are the common representatives of the class in England. From the last mentioned, Du Barry's Revalenta Food and the so-called Russian and Egyptian foods are made.

The *Sweet Chestnut*, ground into flour, is largely consumed by the inhabitants of South Europe. Rich in starch and sugar, it contains very little fat. A special preparation of it is sold in England, the so-called Chestnut Flour of Groult. It is exceedingly palatable, and may be generally purchased at the makers of diabetic articles of diet.

The *Acorn*, ground into flour, is even at the present day eaten in Norway and some parts of France. Formerly it was used-extensively, made into a kind of bread, by the poorer classes in England.

The *Almond*, *Cocoa nut*, *Walnut*, *Hazel nut*, *Brazil nut*, and *Green Almond* are the principal members of the so-called oily seeds. From the almond, flour and a kind of biscuit are sometimes made, mainly for use in diabetes. The distinguishing characteristic of this group is a preponderance of fat, the amount ranging from 30 to 40 per cent. This renders them difficult of digestion by all except those possessed of robust stomachs.

For the reason that nuts contain much fat in combination with starch and albumen, they should only be eaten by persons of good digestion, and are unsuitable for children.

We now come to the fourth class, which consists of vegetable produce not seeds nor extracted from seeds. Nevertheless, it furnishes us with a list of highly important articles, calculated admirably to vary our dietary, and to fill up the deficiencies in starch, and especially in salts, which occur in other foods.

(D.)—VEGETABLES AND FRUITS.

Tubers.—The *Potato* consists almost wholly of starch, and is therefore unsuited for the stomachs of young infants. Its richness in this ingredient renders it alone a very insufficient article of diet, but in combination with meat and fish, as in England, or with buttermilk, as in Ireland, it contains all the requisites for a perfect food. Potatoes should be steamed or baked in their skins, rather than boiled, but if the latter method be preferred, the potato should retain its skin during the process, and be pared afterwards, otherwise much waste of material occurs. Salt added to the water in which it is boiled tends to prevent the escape of its saline constituents, and is therefore an advantage. The dyspeptic should shun waxy, and therefore young, potatoes. When the heat has thoroughly broken up the starch grains, a necessary preliminary to its digestion, the potato assumes a floury consistence.

Jerusalem artichoke contains little starch, but about 15 per cent. of sugar. It is highly digestible.

The sweet potato and *yam* are other examples of tubers.

Roots.—The carrot, parsnip, and beetroot are rich in sugar, and therefore nutritious; but somewhat unsuited to dyspeptic people. The turnip has a lower nutritive value, but is more digestible.

Herbaceous articles of food.—The cabbage tribe, including cabbage, greens, brussels sprouts, broccoli and cauliflower, are poor in nutritive value, but rich in salts. They contain much sulphur, and have therefore a tendency to impart a disagreeable odour to water in which they are boiled, and to produce flatus (abdominal gas) of an offensive kind. Seakale, vegetable marrow, spinach, artichoke, tomato, pumpkin, and cooked sorrel, are wholesome and digestible. Celery and cucumber are only digestible when cooked. Lettuce and watercress, amongst raw vegetables, are the only ones suitable for weak stomachs. Onions (cooked) agree well as a rule, and possess slightly laxative properties. Rhubarb (garden) is very rich in salts, and an excellent laxative. Seaweeds of various kinds are eaten by dwellers on the coast, and in some parts of Ireland are largely consumed. When sufficiently soaked, prior to being cooked in milk and water, they are palatable. Their nutritive value is high. They are also occasionally eaten as pickles.

Fungi.—There are many excellent fungi which, owing to English prejudice, are never gathered. The chautarelles and truffles (which are underground fungi) are almost the only recognised ones in Great Britain. But others equally excellent are the Oread, the Blewit (Lepista personata), the Borista (puffball), which must be eaten when solid, white and young, the Helvel, the Mousseron, the Oyster, and many others. For further particulars on the varieties, cooking, etc., of mushrooms, I must refer the reader to the Elementary Text-book of British Fungi, by Mr. Delisle Hay. Fungi are somewhat indigestible.

Table Fruits.—Of small nutritive value, but highly useful on account of the vegetable salts and acids which they contain, they all possess some laxative properties. Unripe fruit tends to decompose in the bowel, producing abdominal pain and diarrhœa. This is, however, very rarely the case with ripe fruit, in which the starch has been converted into sugar, and the vegetable acids have disappeared by oxidation. Fruits tend to diminish the acidity of the blood and urine ; the vegetable salts being converted in the system into alkaline carbonates. Hence, fruit is highly useful in acute and chronic gout and in rheumatism. *The Grape*, eaten fresh, is one of the most useful of fruits, being both nutritious and digestible. Dried, in the form of raisins and currants, they are highly nourishing, on account of the sugar which they contain, but the hardness of their skins renders them difficult of digestion. *Figs*, when fresh, are very digestible—much less so when dried ; but in this latter form they possess more marked laxative properties. *Tamarinds* are also decidedly laxative. They are often mixed with milk, to form tamarind whey, a pleasant and cooling laxative for children and women in the febrile state. The *Orange* possesses laxative properties, and is digestible. The *Lemon*, *Lime*, and *Citron* are mainly used to prepare acid beverages.—They are rich in salts and vegetable acids. The *Apple* is most digestible when cooked. *Plums* and *Cherries* are, in delicate states of the stomach, best avoided. *Pears*, *Peaches*, *Nectarines*, and *Apricots*, when deprived of their skins, are permissible in most cases of dyspepsia. *Gooseberries*, strawberries, raspberries, blackberries, dewberries, bilberries, and white currants, are all fairly digestible. The *Mulberry* possesses slight laxative qualities, and is very digestible. The *Melon* is also a most wholesome fruit for the delicate. It should be eaten with pepper and salt before dinner, or with sugar afterwards. *Bananas* are equally to be recommended. The *date* is highly nutritious. The *pine-apple*, on account of the superabundance of woody fibre (lignose), is best avoided by the dyspeptic.

CHAPTER XV.

REMARKS ON DIETARIES.—VEGETARIANISM.

At the present day no article on dietetics would be considered complete that withheld a notice of the above system. From what I have already said on nutrition in general, it will have become perfectly clear to the reader that we possess in the vegetable kingdom all the necessary constituents of our food, often combined in suitable proportions; whereas, if we except eggs and milk, we must also freely admit that in the animal kingdom, one great food element, viz., starch, is practically absent; and that though the latter substance may, in the human economy, be replaced by fat, yet even this substance is not, in the flesh of animals, combined with the albumens in those proportions most conducive to a healthful diet. There are two classes of vegetarians, the one belonging to a rigid school which excludes milk, butter and cheese; and the other, a larger one, that permits the use of these animal products. The latter persons can scarcely lay just claim to their dietetic title, but I shall in the following summary include them under the one head of vegetarians. I will first give the strong points of the system, and then offer a few critical remarks on them.

1st. Great divines, philosophers, poets, statesmen, warriors, and social reformers have been in all ages ardent adherents of vegetarianism; and whole races of men who have shown every evidence of mental and physical health, have for generations carried out, though perhaps not exclusively, the same system. The following individuals are with justice ranked among its historical supporters:—Pythagoras, Socrates, Zeno the Stoic, Epicurus, Seneca, Buddha, Porphyry, Plutarch, Tertullian, Clement of Alexandria, Chrysostom, Newton, Milton, Byron, Ray, Rousseau, Cuvier, Buffon, Voltaire, Wesley, Lambe, Lamartine, Schiller, and Linnæus. As examples of vegetarian races in olden times, the Greeks of Leonidas, the Persians of Cyrus, and the Swedes of Gustavus Wasa, may be put in evidence. At the present day the Arabs, the Hindoos, and the poorer classes in Russia, Norway, Sweden, Switzerland, Holland, Italy, many parts of Belguim, France and Germany, Spain, Scotland and Ireland, are all living witnesses of the possibility of maintaining healthy vigour on an almost purely vegetable diet. Many of the religious confraternities and sisterhoods in the Catholic Church are strictly and rigidly vegetarian. The monks of the orders of St. Benedict, of St. Francis of Paula, of St. Dominic, of St. Basil, and of La Trappe, and the nuns of the rule of the Poor Clares, are but examples of a few among many communities who rigidly follow this dietetic system.

2. From his anatomical and physiological relationships it is fair to conclude that man is, by nature, vegetarian. Linnæus placed him with the apes in the order of Primates, and there can be no doubt that, regarded *simply in his animal functions*, man possesses to these latter as close an analogy as exists between any other two animals, not actually belonging to the same family. Now, the food of all monkeys is strictly vegetarian, and I believe in every zoological collection they are fed and thrive solely on such a diet. On this point Professor Owen says: "The apes and monkeys, which man closely resembles in dentition, derive their food from fruit, grains, the kernels of nuts, and other forms in which the most sapid and nutritions tissues of the vegetable kingdom are elaborated;" and again: "The close resemblance between the quadrumanous and human dentition shows that man was from the beginning adapted to eat the 'fruits of the trees of the garden.'"*

The great Baron Cuvier says: "The natural food of man, judging from his structure, appears to consist principally of the fruits, roots and other succulent parts of vegetables."†

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* Odontography, p. 471.

† Orr, London, 1840, p. 46.

Sir Henry Thompson says:* "We have already seen that not only can all that is necessary for the human body be supplied by the vegetable kingdom solely, but that, as a matter of fact, the world's population is, to a large extent, supported by vegetable products. Between about forty and sixty degrees of latitude we find large populations of fine races trained to be the best labourers in the world on little more than cereals and legumes, with milk (butter and cheese) as food."

Sir Lyon Playfair says: "In the case of the horse, the working power is got out of plants; in the case of man it is derived from a mixed animal diet. Yet such a diet is not essential to man. The miners of Chili, who work like horses, live nearly like them, for two loaves in the morning, boiled beans in the day, and roasted grain at night, constitute their ordinary food."

3. The food of the vegetarian is not so apt to convey disease as that of the mixed feeder.—The flesh eater has to consume some blood, and that fluid contains the sewage of the body. Dr. A. Carpenter says that it has been shown in a court of law that ninety per cent. of the animals slaughtered for the Metropolitan Market are infected with tubercle. It is reasonable to conclude that in some cases, at least, such tubercle must result in harm to the consumer. Again, parasites, such as the tape-worm ?? and the trichina spiralis, come exclusively from meat.

4. The practice of slaughtering animals is cruel, and the act has a brutalising effect on the performers, and the exposure of the carcasses is revolting.

5. Vegetable food is, for its nutritive value, far cheaper than animal food; and land on which grain is grown is capable of supporting many more people than an equal acreage on which cattle only are reared.

6. Experience shows that vegetable foods are more digestible than the others, and that the temptation to consume an excess of nitrogenous food, and thereby to bring on gout, rheumatism, kidney disease, stone, etc., is much less. Vegetarians as a matter of fact are comparatively rarely the subjects of such complaints.

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* Foods and Feeding, p. 26.

7. The consumption of a stimulating food, such as meat, leads readily to a craving for other forms of stimulants, such as alcohol; or, on the other hand, by its excitement of the nervous system meat prompts often to the use of soothing narcotics, such as tobacco. The undoubted comparative temperance (in alcohol and tobacco) of the vegetarians is cited in triumphant proof of this.

Now for a few remarks on these various statements. With regard to the first: though it can be shown that many great men were vegetarians, yet the number and weight of those who were not so is overwhelming. Though whole races are vegetarian, yet this is not solely by preference, but much more often of necessity; while in such considerations as strength, health, and longevity, climate, race, and occupation have perhaps more to do with the result than the dietetic system. The second point we may perhaps concede. As to the third, the question of the infection of man by the consumption of *cooked* flesh is not by any means settled, though we must concede that in eating animals more risk is incurred than in consuming herbs. With regard to the slaughtering of animals, it may fairly be retorted that, were it not for the purpose of slaughter, not a tithe of the animals would ever see the light of day; and though death may be painful to them, yet a short life is better than none at all. The fifth and sixth contentions may be granted. With regard to the seventh, though it be conceded that vegetarians are exceptionally abstemious, as far as alcohol is concerned, yet this cannot *wholly* be ascribed to their system, for the same may be said of the Quakers, of the Mahommedans, and even of the Mormons, who are not strict vegetarian feeders.

Further, as against the *rigid* vegetarian system we may instance that the natural food of a baby is the maternal milk, which is purely an animal substance. That in the Arctic regions life on a vegetarian system would be impossible, since the supplies would not be forthcoming. That, furthermore, the world is not so full of enjoyment that mankind need debar itself from any variations in diet which cannot be said to do marked harm, and against the use of which no great reformer has ever preached a crusade.

The following are the conclusions, partly theoretical, partly based on experience, to which I have arrived on this question :—

Vegetarianism is useful—

(1.) As an economical mode of living.

(2.) As a *very useful* adjunct in treating alcoholic craving. Many cases of advanced alcoholism may be arrested if the vegetarian system be adopted and adhered to.

(3.) As an excellent therapeutic measure in the treatment of the following complaints.

(*a*) *Gout.*—The great Dr. Cullen first pointed out the special advantages of exclusive vegetarianism in this complaint. The results of such treatment are often highly satisfactory. One of the great reasons, to my mind, why this disease is so rare in Scotland is, that the poorer classes consume little in the way of meat.

(*b*) *Chronic Rheumatism.*—This disease has a very similar causation to that of the preceding.

(*c*) *Acute Rheumatism.*—Recurrent attacks of this complaint can often be warded off by recourse to a vegetarian dietary.

(*d*) *Epilepsy.*—Those forms of this complalnt which are not due to actual structural defect, tumours, etc., on the brain, are not unfrequently largely benefited, even occasionally cured, by a restricted vegetarian regimen. I have recently published in the "Journal of Reconstructives," some remarkably satisfactory results in the treatment of epilepsy on such a plan.

(*e*) *Bright's Disease* of the kidney, of the gouty form. As 90 per cent. of the sufferers from this form of kidney mischief owe their malady to gout or alcohol, it follows that, if vegetarianism be useful in the latter conditions, it is worthy at least of a trial in a common result thereof. Vegetarianism cannot, however, *cure* the above disease ; for it is a degeneration, and incurable, but the vegetarian system will prolong life and prevent much suffering.

(*f*) *Dyspepsia of some kinds.*—As a last resource I have tried the vegetarian system in all forms of chronic dyspepsia, in many cases with most encouraging results, and in not a few with absolute success ; but perhaps the class of dyspeptics to whom, from my experience, I should be most inclined to recommend this dietetic system, is that large one in whom a *tendency to gout* has much to do with the stomachic and intestinal trouble. In the typically bilious people—black-haired, sallow-skinned individuals, this system, when rigidly adhered to, often does more good than anything else in preventing the frequent recurrence of the attacks. Finally, both in acute and chronic inflammatory disorders of the stomach, it often is of great service, as well as in that form of atonic dyspepsia seen in persons who lead sedentary lives.

(*g*) *Constipation.*—The waste material in the vegetable kingdom is relatively both more plentiful and more stimulating to the intestines than that found in the animal kingdom. The effects of whole meal, oatmeal and other porridges, and of fresh and dried fruits, in preventing constipation, is well known.

In recommending, or in undertaking oneself, a vegetarian dietary, the best method to proceed, is to purchase a book on the vegetarian system and on its culinary departments. It will not do to attempt a dependence on the vegetable constituents of an ordinary mixed dietary. Books containing full instructions can be obtained at the offices of the Vegetarian Society, 75, Princess-street, Manchester.

I am not a vegetarian myself, and deprecate, as a general rule, the adoption of any *ism*. But every system that numbers, as does the Vegetarian Society, many intelligent people amongst its members, must contain some valuable germs of truth, and it is the duty, to my mind, of every man who aspires to be a teacher and healer of men, to endeavour to discover these, and apply them to the general good of humanity; and—a point that is sometimes forgotten—to give credit to the source from which they were derived.

The following short appendix of rules is applicable to all dietetic systems:—(1) Take a good breakfast. It is the meal most easily digested. (2) Use as much variety in your food as possible. (3) Masticate well. This applies specially to starchy foods. It is not so important with meat, as the saliva has no digestive power over it. The herbivorous animals it will be remarked, chew much; the carnivorous ones only *tear* and then bolt their food. (4) In health do not drink much. (5) Appetite is the best sauce. Condiments and stimulants are, in health best avoided. They excite thirst and tend to over-stimulate the stomach, an error for which it will have subsequently to pay. (6) Do not drink when eating. Imperfectly masticated food is apt, in so doing, to be washed down. (7) Eat seldom, and at regular times. Three times in the twenty-four hours is a sufficient number of meals for most adults. (8) Take plenty of time with each meal, and when eating it, try and dismiss all worry and anxiety from your mind. (9) See that your life be right in all respects. Exercise, fresh air, and reasonable enjoyment, are better than all the pepsin and pancreatin in the world. (10) The last meal in the day should be a light one, if it be taken within two or three hours of bedtime.

COOKING.

The object of cooking may be said to be twofold: to lessen the cohesion by which various substances are held together, and to cause certain ingredients of our foods to undergo a change of form, by means of which our digestive ferments can gain access to them. Both of the above beneficial processes are, in most instances, simultaneously at work. We have evidence of them every time we cook any form of seed, the woody fibre holding together the various ingredients in the grain, swells up and softens under the action of heat, especially when moisture is allowed free access to it, and permits of the ready disintegration of its contents. The albuminous parts coagulate—a process which, at first sight, might seem unfavourable to ready digestion, but is not necessarily so, since the human stomach and the pancreas both prepare a milk-curdling ferment whereby the albumen in that fluid is rapidly rendered solid directly it enters the digestive track. The fats are rendered more fluid by the action of heat, and therefore in a state to undergo easy emulsification in the intestine, and the starch grains, which consist of concentric layers, the outer one of which is hard, and offers great resistance to the action of human saliva, are caused thereby to swell up and burst, thus submitting all their contents readily to the digestive ferments in the saliva and pancreatic juice. But cooking not only renders our food softer and more palatable, and brings it more readily within the power of the digestive agencies, it often—and this is most important—destroys many of the forms of animal and vegetable life that lurk in it, and that otherwise might do our bodies very serious injuries. All known parasites, visible to the naked eye, are destroyed by a heat equal to that of boiling water, and many of them at even a lower temperature, and all the microscopic ones are killed by such a heat if moisture be present. Cold is not by any means equally fatal, indeed, most forms of bacteria are but little affected by it, and many can withstand a temperature considerably below freezing point. The effect of such cold is to lessen their movements, which, however, are restored again on the application of warmth.

Such are, perhaps, from a physiological point of view, the main advantages of cooking. It, however, has also certain drawbacks. It robs foods of much of their salty constituents; and this is specially true of vegetable food, which it is therefore the custom to boil in well-salted water. Again, the effect of prolonged dry heat on fats is to provoke a change in them whereby they readily undergo fermentation in the stomach. Hot roast meats, when fat, are therefore notoriously *rich*, and are often perforce shunned by the dyspeptic. Then heat has certain special effects upon some articles of food. If at all great, it renders the oyster indigestible, while it has the power of slowly converting dry starch into grape sugar, as seen in the easily-digestible baked flour.

I had, when commencing this book, proposed to myself to enter somewhat fully into a description of the various culinary processes and the modifications of them necessary in invalid cookery, and to add a list of recipes for special dishes suitable for the invalid; but I find the literature on the subject already so copious, so exhaustive, and so excellent, that I feel, in the very limited space at my command, disinclined to enter on this department.

CONDITIONS HAVING A MODIFYING INFLUENCE ON DIETARY.

Hereditary or acquired disease and derangement and other special states.—These will have a very marked influence. Different doctors pursue somewhat different methods; and at different times introduce different fashions into medicine. Thirty years ago the fever stricken were kept low; then Dr. Stokes, of Dublin, introduced and vaunted the feeding up of such patients. And now that recent investigations have brought to light the fact that the digestive functions, especially the tertiary ones, are almost, if not quite, arrested in fevers, there is a tendency, and I think a wise one, to revert to a restricted dietary. Some modern doctors praise highly the predigested foods, the malted, pancreatised and peptonised preparations, and would have us administer these very largely in all febrile states; but as it is only possible to put such foods through the *primary* stages of digestion, and the great difficulty in fever lies with the *tertiary*, little, if any good, can be expected from that course. On the whole, in most cases of *high* fever it will be well to restrict the individual to diluted milks, thin broths, gruels, jellies, and suitable fruits. When the temperature falls, and in proportion to its decline, cereal preparations may be added, and these may be malted. It is well in this stage to leave out eggs. When the fever leaves and the invalid enters the convalescent stage, fish of the white variety and of the more digestible and dainty sorts, steamed by preference,* and a little game or poultry, may cautiously be added.

Alcohol in all three stages is often necessary. The directions for its use rest with the medical attendant.

For the chronic invalid, suffering from more or less intermittent fever, due to slow inflammatory changes, cases of cancer, of consumption, of Bright's disease, of scrofulous bone disease, etc., the diet must be light, but *very nutritious*. Vegetarian cookery can be largely relied on. Fats and oils, such as cream, butter, and cod-liver oil, are useful. Malted starchy foods here find a useful place. The meals should be small, and pretty frequent, but not so frequent as to worry the sufferer. Wines of good quality, Burgundies, old port, &c., may, as a rule, be permitted, and also malt liquors. Spirits, unless in exceptional cases, are best avoided.

Chronic Gout and Rheumatism.—Here the great point to remember is, that the nitrogenous foods should be conspicuous by their comparative absence. Meat at one meal—the midday—will be, as a rule, sufficient. It should be followed by fruit only. The other meals should consist largely of cereals. Fats are theoretically unobjectionable, but are badly borne. If the general strength be good, *abstinence* is the key-note in the dietetic treatment of gout. Bland fluids may, however, be allowed freely. If alcohol be needed, gin, whisky, and natural dry white wines, are the only suitable forms.

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*An excellent kettle for steaming fish is made by Orme, Evans & Co. of Wolverhampton.

In the lying-in room, the diet must be simple and nourishing. Whilst in bed, the patient, like all other people at rest, will require but little animal food. The third or fourth day after accouchement, will be time to commence its administration. It may, even then, often preferably take the form of boiled or steamed fish. Cereal foods, combined with milk, may be largely administered. Fruits of a digestible sort, and of a ripe age, need not be withheld. Alcohol is not, as a rule, necessary, but if particularly desired by the patient, it may take the form of a dry wine or of light malt liquor, and be permitted towards the end of the first week. Speaking from a review of considerably over two thousand cases of this sort, attended by myself in London, I must say that the less of so-called treatment and the more of common sense that is brought to bear on the direction of the first three or four weeks that succeed parturition, the greater will be the comfort and safety of the mother. Above everything, all attendants, and the invalid herself, should be taught to regard the condition as a perfectly *physiological* one, and not in any sense as a disorder.

Of the various dyspeptic derangements, and of the dietetic rules on which their treatment should be based, I have already spoken. We may, therefore, pass on to the question of:—

The effect of age on dietary.—In the first year of life, milk must be the main food, and in the first six months, it should, if possible, be the *only* food. The cases in which it does not agree are exceedingly rare—tact and perseverance will, almost always, overcome all difficulties in this respect. Prior to the appearance of teeth, foods stand thus in the order of precedence.

(1) Mother's milk. (2) Wet-nurse's milk. (3) Humanised

milk made by Frankland's method. (4) Cow's milk and water, commencing with one third of milk (preferably boiled), to two-thirds of water (also boiled), slightly sweetened. It may be made, at first, *even weaker than this.* In the course of a week or ten days, the strength should be cautiously raised to about equal parts of milk and water. (5) Condensed milk, one teaspoonful to two-thirds of a feeding-bottle full of water, will be strong enough to commence with. The strength may be gradually raised to one teaspoonful to half a bottle. A dessert-spoonful of fresh cream to each bottleful is a good addition.* (6) *Good* malted foods. The various baby foods, Œttle's, Nestle's, Savory and Moore's, etc. (7) Baked flour, with condensed milk. (8) Cocoa, Van Houten's, Fry's or Cadbury's, made with half milk, half water.

With the advent of teeth, the diet may cautiously be increased to one part of fine oatmeal to two parts of baked flour. Two table-spoonsful of such a mixture in half a pint of milk, the whole to be well boiled and sweetened, makes a capital food. Bread, biscuit, well-ground wheat meal and maize meal, may be pressed into the service. Sago, tapioca, cornflour and arrowroot—substances to which, I suppose from their soft and white character, nurses have a strong leaning—are best kept out of a child's dietary till after six or eight teeth are cut. They consist of *pure starch,* a substance not thoroughly digested till the second year of life has been completed.

In the period from two to ten years, the diet may be full, but simple. *Little meat* is required. The cereals are mainly to be depended on, and in the latter part of the time fruit may be freely allowed. Sugar in all its shapes and forms is useful at this period, and so is fat, which, if otherwise distasteful, may be given as cream, with fruit. Milk, of course, should still occupy a very prominent place. Fish and eggs are useful substances for a midday meal. Potatoes, parsnips, carrots, and turnips are also to be commended. Green vegetables are not so suitable.

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* Many excellent condensed milks are in the market, bottled and tinned, sweetened and unsweetened. My remarks apply only to the ordinary tinned varieties. With regard to the others, the special direction provided with the article itself must be followed.

In the succeeding period, that from ten to twenty years of age, the diet must be liberal. This is of great importance. The old-fashioned school dietary was usually faulty, and, as a result, had to be supplemented with cakes—at best but an indifferent form of food. Boys and girls should have an abundance of simple, and nourishing food, and should be encouraged to eat it. They have to *build*, out of what their parents and guardians provide them with at this period, the future man and woman. The appetite of boys requires, as a rule, no temptation; that of girls should be encouraged by physical exercise, gymnastics, cricket, etc. Mismanagement in diet and exercise at this period often means for the future woman a sickly mind in a sickly body.

At this period meat may, as a rule, be freely consumed. It is a highly nitrogenous food, and as cell structure is in progress, nitrogen must be well represented. Fruits and vegetables should also occupy a prominent place.

From twenty or twenty-five to forty years, the dietary will of necessity vary much with the occupation. That for a sedentary life must be simple and unstimulating, containing little meat and less alcohol. The active man may, however, take two good meat meals a day—breakfast and dinner—and indulge, often with benefit, in a fair lunch and supper as well. A little beer or wine, as a rule, will do him no harm. Spirits he should avoid. They stand in reserve for the days of want and trial, which may never come to him if he order his life aright.

From forty or forty-five years to the limit of life, the diet should gradually simplify itself. Vegetarianism is often a good system during this period. Nitrogenous foods, such as meats, afford satisfaction, on account of their stimulating properties, but their extensive use is fraught with grave danger. No building, only just a little patching, is going on in the body. Uric acid, and with it gout and chronic rheumatism, are to be dreaded, and they are the direct result of an ill-digested excess of nitrogenous material. Stone, gravel, and Bright's disease lurk, again, behind gout, or may even precede its open manifestations. Alcohol may or may not be required. Its use is best postponed for as long as possible. It means the calling up of capital, the store of which is getting low. The man who reaches a venerable old age, and retains his faculties till the last, is nearly always abstemious.

Sex.—Up to twenty years of age the dietary may be alike in kind, and often in amount, in the two sexes. After that period, inasmuch as a woman leads, as a rule, a more sedentary life than that of a man, and on the whole, requires, for structural reasons, a lower dietary, her food should be less in amount, and of not such a stimulating nature. During the periods of suckling, fats and milk may enter largely into the dietary, and malt liquors may be allowed in small quantities; but a healthy woman is, as a rule, better without them. Wet-nurses should be dieted like nursing mothers, not pampered and stuffed with meats and bottled stout, as was formerly, and is still to some extent, the fashion.

In old age the dietary of the two sexes becomes, as in early life, nearly alike both in amount and kind.

Alcohol, in any shape and form, is best omitted from the dietary of women, till they are at least fifty years of age. If the temperament be at all emotional, it should, prior to that period, be most strictly forbidden,

Race.—On this point I need say little. Every child knows that the dwellers in arctic regions love fat, and that as the tropics are approached, the food of the various races becomes, as a rule, simpler and more vegetarian in chraacter, the difference depending upon the temperature of the air and the relative need for bodily heat.

Conditions, surroundings, and idiosyncrasies.—These exercise an important influence on a dietary; but, from their great variety and from the very large number of causes on which they may depend, no general rules anent them would be of any practical use.

PECULIARITIES IN FOOD AFFECTING THEIR DIETETIC VALUE.

Vegetable albumens are, weight for weight, more digestible than animal ones. I have referred to this fact before. Dyspeptics can often consume lentil food when they cannot digest meat. This may not depend, of course, entirely on the albumen in the meat, but on its extractives, its stimulating properties, and the increased exertion that the division of the meat fibres throws on the stomach. Whether the difference resides wholly, if at all, in the albumen or not, the fact remains that vegetable substances are digested with less pain than animal ones, which contain an equivalent amount of nitrogenous material, *i.e.* of albumen.

Fish is more digestible than meat.—The reasons for this probably are that, when cooked, it is more brittle, and falls to pieces more readily, and also that it contains relatively little fat, and more water than meat.

Concentrated foods are not easily digested. Nature seems to exact that a certain amount of what we call waste—up to a certain point the more the better—shall be consumed. Eggs and cheese, both in theory most excellent foods, are, on account of their very concentration, difficult to deal with in the digestive organs. It has been shown experimentally on animals that, even the admixture of *sawdust* with concentrated foods, promotes their digestibility. The vegetable foods contain relatively much more waste than the animal ones. But for the operation of this law against concentration, man might consume as pure albumen, as grape sugar, and as butter or cream, in a few mouthfuls, all the daily food, with the exception of water, that he required. But such a dietary is not tolerated by the digestive organs, nor can the general health and strength be maintained on it.

The admixture of meat and much starch food in one and the same meal is always a bad combination for the man of feeble digestion. For such, meat with bread, rice, or roasted potato, one subsequent course consisting only of vegetables, and followed by ripe fruit, makes the best menu for a midday meal. Milk pudding may be taken for supper.

Combinations of fat and starch, such as pastry, are both indigestible, and of doubtful nutritive value. Currant cakes are equally bad, because of the sugar they contain, of the currants, which, on account of the insolubilityof their husks, set up intestinal irritation, and of the butter, which, as in pastry, binds the starch grains together and prevents or retards their admixture with the salivary and pancreatic juices.

AIDS TO PRIMARY DIGESTION.

Thanks to medical research and to the scientific skill of the manufacturing chemist, we possess, in the form of artificial digestive agents, admirable substitutes for the natural ferments when they are defective.

In *Malt* there exists a ferment called Diastase, identical in power and almost so in structure with the Ptyalin found in the salivary, and the Amylopsin in the pancreatic, fluid. They all three possess the function of changing starch into soluble grape sugar. They are therefore all spoken of together as the diastatic ferments. Malt, as I have said in an earlier part of this work, is at the present day, an extremely common ingredient in infants' and invalids' farinaceous foods. Two cautions in regard to its use are necessary : the first refers to infants only. Though malted foods may, and often do, agree with them, it should be remembered that *even digested* starch is not a substitute for milk, and that the *mere fattening* of an infant is no proof of dietetic success. If it were, the well-filled-out middle-aged toper and the robust-looking brewer's man would be types of bodily perfection, when, as a matter of fact, they are the reverse. In infancy, digested starch can only be an aid, and an occasional aid, given under medical advice, to any system of feeding. Of course, after the teeth, three or four of them, are through, the state of matters alters, and starch may occupy a higher and more important place.

Malted foods should be, like all other predigested foods, purchased from a reliable house. The known skill and conscientiousness of a maker is the best guarantee for the public. A better plan than the use of malted food is the purchase of ground malt and the admixture of it with cereal food. A small teaspoonful of such malt flour may be mixed with, or sprinkled over, a cooked farinaceous pudding, or mixed with gruel, bread and milk, arrowroot, or rice and milk. The time to add the flour is after cooking, and just about the point when the foods are cool enough to sip. After the addition has been made, it is well to place the dish in the oven for ten minutes or a quarter of an hour, to allow full time for the diastatic action.

Pepsin and Pancreatin.—When Eberle, in 1834, first succeeded in preparing pepsin from the stomach of the pig, dyspeptics became jubilant, and imagined that the end of their troubles was at hand. They were vastly mistaken. The idea prevalent at that time, that the stomach was almost the sole organ concerned in the digestive process, was, as we now know, altogether fallacious, and therefore pepsin, even when most carefully prepared and admixed with a sufficiency of acid, failed to do more than slightly relieve a few cases in which the transformation of albuminoids into peptones was at fault. And very rarely indeed, for the two score years that succeeded Eberle's discovery, was the pepsin sold of any real value whatever. Badly prepared, spoilt by indifferent keeping, or administered without the necessary acid, or with foods over which it had no power, it may fairly be said that much the larger quantity consumed was completely inert. Then foods, predigested by its agency and sold as such, had, as a rule, a disagreeable bitter taste, which rendered them unpalatable. The demand for these was small, and that even for the active preparations of pepsin extracted by von Wittich's method with glycerine, and sold by several English houses, was dying down, when, owing largely to the researches of Dr. Kuhne and of Sir William Roberts, of Manchester, the digestive powers possessed by the pancreatic juice were more fully explained, and hope was held out that in the extraction of it from the body of the pig for the use of the dyspeptic, a real and solid success might be looked for. To a large extent these hopes have been realised, and thanks to the energies of such houses as those of Benger of Manchester, Savory and Moore, Burroughs and Welcome, and W. Jones, of London, not to mention many others, really active digestive ferments and thoroughly predigested foods are within the means of almost everyone.

Some of the most useful forms in which the pancreatic ferments are sold are the following:—

Pancreatic Solution of Benger (Liquor Pancreaticus) 1 to 1½ teaspoonsful in water, with a pinch of bicarbonate of soda, two or three hours after a meal.

Benger's Alkaline Pancreatic Powder, 20 grains in each powder. One in water two or three hours after food. One of these powders will in 30 minutes artificially complete the digestion of a pint of milk, kept warm upon the hob, or in the oven.

Fairchild's Preparations.—in small bottles, as powder, or compressed into tablets.

Savory and Moore's Neutral and Saline Essences of Pancreatin. The directions for the self administration of both the latter preparations are given with each, and, as they are somewhat full, I shall not repeat them here.

The great advantage of the pancreatic preparations over all others is, that they act pretty equally upon *all* the ingredients in food, and the great advantage of this is seen when we consider that nearly all the dishes we consme are really combinations of albumen, starch and fat. You can, therefore, pancreatise beef tea, gruel, milk, jellies, blancmanges, farinaceous foods, and even fats, etc., all pretty equally ; whereas malt has power only over starch, and pepsin only over albumen. The fullest directions how to predigest almost every conceivable kind of food are obtainable with all the preparations of pancreatic ferments.

One final word of advice. Artificial aids to digestion and predigested foods in general are only of real service when the *secondary and tertiary digestions* of the individual are in good order. We cannot, therefore, place much reliance on them in fevers or in any form of blood disease, nor in conditions where the liver is swelled and congested, a frequent cause of so-called stomachic and bowel debility. As producers of fat in people who, in spite of a generally satisfactory state of health, remain remarkably spare, they are often productive of marked good, and in some conditions, frequent in delicate ladies and children, where the dyspepsia is apparently limited to the stomach and intestine, they are also serviceable. But it is well never to resort to them till all other, and more natural, means have failed to effect good ; for even if artificial aids to digestion succeed in increasing the weight of the individual, it must be remembered that they do not effect this *by strengthening and improving the digestive powers*, but by temporarily superseding them ; and that if their use be persisted in too long, they may even lead to further incompetency. We must then regard our pancreatic and other preparations, as crutches—bad things for a man whose locomotive powers are but slightly impaired, indispensable where all power of locomotion is temporarily or permanently lost.

CHAPTER XVI.

BEVERAGES.

WATER, the natural beverage of man, which exists in his tissues to the extent of 70 to 85 per cent. and in the food he consumes to an almost equal amount, is practically divisible into two kinds, named, according to their action on soap, "hard" and "soft" water.

The hard waters, which are derived from springs and wells, are those preferred for drinking purposes. The cause of this preference is two-fold. Firstly, the earthy salts, sulphate of lime, etc., which they contain, and their sparkling appearance, which latter they owe to the presence of contained air and carbonic acid gas, render them at once palatable and pleasing to the eye; and secondly, these same earthy salts free the water largely from the risks of contamination, which might otherwise occur by its contact with the leaden pipes, in which it is conveyed, or with the leaden cisterns in which it is often stored.

Now a word or two as to the protective value of certain salts against lead, for this subject seems, even in well-informed circles, to be by no means understood. As a guard against the action of water, or rather of the oxygen in water, on lead, stands first in the list *silica* (the dioxide of silicon), which exists largely in gravel, sand, agate, granite, glass, etc., and is one of the most abundant substances in nature. Then come the earthy sulphates, which, when present in water that is being conveyed by, or stored in, leaden substances, forms a sulphate of lead, which, deposited as a thin scale on the surface of that metal, effectually protects by its insolubility the water from further contamination.

Next to the sulphates, in this respect, come the phosphates: which, like the former, manufacture a protective crust. Last of all come the carbonates, but the encrustation of carbonate of lead is apt to be dissolved off by any excess of carbonic acid present in the water, and therefore waters that can depend for protection only on these salts are to be mistrusted.

Soft water.—This, as my readers are well aware, is almost synonymous with rain water, at least in popular language. Distilled water is, however, in the strict sense of the word, included by the term. Rain water is unsuitable as a beverage, owing to the many impurities with which it, as a rule, comes in contact in the means used for its collection, to its proneness to decompose, and to the solvent action which the oxygen it contains has on metallic lead, and whereby the oxide of lead, a tasteless and insidious poison, is produced.

Spring waters belong to the hard variety; lake and river waters are combinations of spring and rain water, and these latter, according to the amount and kind of salts which they hold in solution, may or may not be suitable as beverages, when allowed to remain in contact with the metal to which I have referred.

Pure water.—In Great Britain, where the sources of drinking-water are, as a rule, under the skilled eye of competent and responsible men, there exists but little fear of the conveyance of any disease by its agency; but on the continent of Europe, where, in many places, much attention has not been devoted to the subject, water that is open *prima facie* to grave suspicion is still used as a beverage, being frequently drawn from those most dangerous of all sources, superficial wells. To these, decomposing organic matter from the neighbourhood, in a fluid state, readily gains access. The risk is often all the greater as the traveller hears that typhoid and other fevers, which he has been taught result directly from the imbibition of tainted water, are almost unknown in the neighbourhood. But this is always a deceptive guide, for experience abundantly confirms the somewhat curious fact that, in the course of time, people become proof against this and similar diseases, though they may habitually consume water loaded with the *materies morbi*, as the unfortunate stranger, trusting to the general health of the community, will often discover, only when he is prostrated with the malady, as the result of a single draught.

There are innumerable tests whereby the fitness for drinking of doubtful water may be determined, all, doubtless excellent, but unfortunately complicated, and as people will often run considerable risks rather than put themselves to a little trouble, such tests remain unknown, or are ignored. A very small amount of Condy's fluid will serve as an adequate test for nearly all the drinking-waters in Europe. One or two drops of that fluid, just sufficient to give a pink colour and no more, may be added to a tumbler of the water on trial, and if, in twenty-four hours, the pink colour is in any way lost, especially if it rapidly turn to a decided brown, the water must be unhesitatingly condemned. But all doubtful water should be subjected to boiling. That process destroys at once and completely all risk of mischief from any contained organic matter. Boiled water has, however, a disagreeable flat taste, from the fact that the air and carbonic acid have been expelled therefrom ; and it is well, therefore, in order to restore the flavour, subsequently to pass such water through a filter.

Filtration simply should never be relied on. It renders water clear and sparkling, but has often no further effect on it. Indeed, many filters, while still retaining this mechanical power of holding back suspended earthy matter, are, from their neglected state, a source of considerable danger to any water, even if it be pure, that is placed in them. Amongst filters those whose filtering agent is spongy iron are, in my opinion, and, I believe, in that of the best authorities, very decidedly the most efficient.

MINERAL WATERS.

From time immemorial mineral waters have been used as curative agencies in medicine. There is certainly no sign in modern times of a decline in their popularity. Much of the benefit which they effect is, no doubt, to be placed less to their credit than to that of the climate of the places where they are found, and to the beneficial general régime to which the often pampered invalid has there to submit himself. Recent investigations have, however, brought to light another unsuspected cause for the renown which attaches to many of them. The spectroscope, coming to the aid of the coarser methods of analysis, has proved in many of the waters which were supposed to consist simply of very ordinary saline ingredients, such as Epsom or Glauber's salts, the existence of minute, but very decided, traces of strontium, lithium, arsenic, etc., which may, and very probably do, have a great deal to do with the results. For, as I said when treating of tertiary dyspepsia, we are by no means as yet sure as to the magnitude of the parts played in our system by the salts, though these, as regards *mere amount*, occupy a secondary place to all the other ingredients in necessary food.

The mineral waters are divided as follow :—

Bitter waters.—These owe their virtues largely to the presence of Epsom salts (whence their bitterness), Glauber's salt, and a variable amount of common salt. In full doses they act as purgatives, in smaller and constant ones, as stomachics, with a specially depletive effect on a congested state of the liver and intestine. They are, therefore, often useful for invalids whose lives have been very sedentary or very luxurious, and for all whose dietary, constantly in excess of their requirements, has produced a state of engorgement of those abdominal organs. The following are the most useful of these waters :—Æsculap, Friederichshall, Hunyadi Janos, Hunyadi Laszlo, Leamington Spa, Pullna, Rubinat, Seidlitz, Saidschutz, Epsom, and Cheltenham.

Alkaline waters.—These contain considerable amounts of bicarbonate of potassium, of sodium, of magnesium, or of lithium, combined with smaller amounts of Glauber's salt and of common salt, and their field of utility is, therefore, gout, rheumatism, some forms of stone, and that common form of Bright's disease, the cirrhotic or gouty kidney. Bethesda, Cordillac, Contrexéville, Giesshubler, Marienbad, Royat, St. Galmier, Noel, Saratoga, Tarasp, and Sulis water (from Bath) are of this order. Some of the alkaline waters contain, in addition to the ingredients I have named, variable proportions of carbonic acid, and are, therefore, sometimes placed in a separate rank, as—

Alkaline acidulated waters.—Such are Apollinaris, Bilin, Geilnau, Neuenahr, Vals, Vals-vivavaises, Ems, Saltzbrunn, Vichy (Grand Grille, Hôpital, Celestins, and Hauterive springs). Two of this class, those of Franzensbad and Schwalheim, contain, in addition, notable traces of iron, and are, therefore, suitable for cases marked by great debility and poverty of blood.

Ferruginous or iron waters.—These are of most service in cases of anœmia, or poverty of blood, whether from excessive loss or from deficient manufacture of that fluid. Pyrmont, St. Moritz, Swalbach, Driburg, Griesbach, the Mesdames spring at Vichy, and Spa belong to this class.

Sulphurous waters.—These are of service in many scrofulous affections and in some skin diseases. Aix-la-Chapelle, Aix-les-Bains, Bonnes, Cauterets, Enghien, Harrogate, and Weilbach are the most noted.

Salt or brine waters.—These hold in solution, amongst other ingredients, a large amount of common salt. They are mainly useful in indolent enlargements and scrofulous affections. Such are Carlsbad, Adelheidsquelle, Kissingen, Homberg, Kreuznach, Wiesbaden, Marienbad, and Woodhall Spa.

Table waters.—These are so called as, holding but a small proportion of mineral matter in solution, they may be partaken freely of with ordinary meals. Eau de César, St. Galmier, Malvern, Condillac, and Apollinaris are of this class.

Arsenical waters.—Those of La Bourbourle, Royal St. Mart, and St. Victor contain this metal, and are recommended mainly in obstinate skin complaints, and in certain female derangements. The waters of St. Boes at Mounicq, in the Basses Pyrénées, France, contain, in addition to arsenic, naphtha, sulphuretted hydrogen, and iodine.

DECOCTIONS MADE WITH VEGETABLE SUBSTANCES.

Tea.—So much is known about this popular beverage that I shall confine myself to such few remarks as may contain novelties interesting to my readers. In the first place, as pointed out, I believe, by Dr. Pavy, the domestic teaspoon, as a measure of the *weight* of tea, is a highly fallacious guide, one teaspoonful of fine gunpowder tea, for example, being the equivalent of more than *three* of Oolong, and almost three of inferior Congou. The best Congou, again, tested by the same measurement, is equal to more than double that of its inferior varieties. The Chinese, as is well known, drink their tea without milk or sugar, and often add lemon juice to it. In Australia and New Zealand cold tea, similarly flavoured, is a favourite beverage amongst those, such as wool-clippers and harvesters, whose work is fatiguing, and who are exposed to great solar heat. In France, Germany, and Austria, tea, sweetened with sugar and flavoured with cinnamon, vanilla, aniseed, &c., but without milk, is consumed. The Tartars again *eat* the powdered leaf mixed with fat, meal, salt, etc. On analysis, tea yields three principal ingredients—volatile oil, tannin, and theine.

To the volatile oil tea owes its aroma, which, as we know, is soon lost if the infusion be long exposed to the air, or if it be allowed to boil.

Tannin is the *bête-noire* of the tea drinker. To hear people speak, one might imagine that the tea-leaf was the sole source in creation of this substance, whereas there are very few derivatives of the vegetable kingdom that are free from it. No doubt it exists very largely in tea, the black variety containing from 10 to 13, the green as high as 18 per cent., but comparatively little of this is dissolved out in the infusion as it is usually made. It is no uncommon thing to find people who ascribe most of their stomachic derangements to the presence of this ingredient in the half-pint of tea which they consume in the twenty-four hours, when within the same period they are swallowing in coffee and claret something like double the amount of tannin. There can be no doubt that tannin has a deterrent effect on the salivary and peptic digestion, but the part played by it in the production of dyspepsia has been considerably overstated. I have had some five years' experience of life in the Australian Colonies, and, although among Colonials the average consumption of tea—and that of the rougher and worse varieties, not unfrequently subjected to boiling—per man is, at a moderate computation, three times greater than that of the home Briton, I cannot call to mind one single case of dyspepsia attributable to that article. In China, again, though it is consumed in enormous quantities, no writer, that I am aware of, has referred to any common national disease or derangement resulting therefrom. If the general health of an individual be good, tea will not do him or her the least appreciable harm, and I am very strongly of opinion that it is this method of ascribing a general failure of health to small and comparatively unimportant deviations from an ideal standard of Hygiene, which has brought, and still does bring, medical treatment and medical advice into no small disrepute with the more thoughtful part of the public. In all cases of marked dyspepsia there is much more than the consumption of half-a-dozen grains of tannin per diem at fault; and, in nine cases out of ten, the dyspeptic is well aware of the fact himself, but from a natural disinclination to be too communicative, or possibly in the vain hope that the sacrifice of a comparatively insipid beverage, such as tea, may enable him yet, in most things, to defy with impunity the laws of nature, he accepts the conclusion of his doctor, and tea is banned. Then the utter insufficiency of that beverage as a cause of much bodily derangement soon becomes apparent. But as tannin does not certainly tend to favour the digestive process, it may be as well to give a method whereby its evil tendency may be neutralised. According to Sir William Roberts, of Manchester, as little as two per cent. of bicarbonate of soda will act as a counterpoise to its drawbacks. Ten grains, therefore, or as much as will lie on a threepenny piece, will be sufficient to neutralise the effect of the tannin in one ounce, *i.e.*, in from five to twelve teaspoonsful, according to the variety of tea used. Such an amount of soda has no appreciable effect on the flavour of the tea.

The evil effects, which sometimes follow excessive tea drinking are due very largely indeed to the swallowing of a quantity of *hot* fluid by persons of feeble digestive power, and whose powers of gastric absorption are consequently impaired. It is especially that class of dyspeptic, whom I have spoken of as the Atonic, which is affected by it, and it is more than probable that with them, as the stomach is known to be wanting in its normal powers of contraction when empty, the sudden introduction of hot fluid may have the effect of drawing from the parts beyond, through its relaxed pyloric outlet, a large amount of flatus.

Theine.—To this stimulating extractive, tea owes its exhilarating powers. This substance is credited, in common with a few other substances—arsenic, caffeine, etc., with the power of arresting, or rather of diminishing, the tissue waste which goes on in the body. Recent and more exact investigations tend, however, to throw great doubt on the possession by it of any such extraordinary effect. As long, however, as there is a possibility of its possessing such qualities, it is wise to employ either the theine or caffeine themselves, or the beverages which contain them, in febrile states, in which, as we know, one of the great dangers to life consists in the rapid, and temporarily irreparable, waste of body tissue. In chemical composition theine has a remarkable affinity to kreatinin, a stimulating crystalline substance found in meat, and to which some of that sense of *satisfaction*, which results from the consumption of flesh foods, is due.

The advantages of tea may be thus summed up:—It is an agreeable, refreshing, and fairly wholesome beverage, and constitutes a medium for the conveyance to the body of some of its necessary fluid. The water with which it is made has been rendered safe by boiling; it warms the body when cold, by virtue of its own heat; it takes the place of less wholesome beverages; and it possesses, like all hot beverages, a powerfully stimulating effect on the heart. The sugar and milk with which it is drunk, and the theine and gluten it contains, impart to it nutritive properties. It has the power of relieving certain conditions of the nervous system, notably nervous headache. Its drawbacks are, the dyspepsia of which I have spoken, and a peculiar form of nervousness which results from the habitual use of the stimulating properties of tea to force the brain to do work beyond its natural powers. This nervousness is not, however, to be ascribed to the effect of the tea, but to the reaction of an overstrained nervous system.

Coffee.—Like tea, this seed—for it is not a berry—consists of three main ingredients: volatile oil, tannin, and caffeine. Both the volatile oil and the tannin are present in much smaller proportions than in tea. Caffeine is chemically identical with theine. The amount present in coffee varies very widely, but, on the whole, this seed contains about one-third less of it than an equal weight of tea does of theine. The making of a good infusion of coffee requires far greater care than the making of the corresponding preparation of tea. With regard to the seed itself, connoisseurs state that this should be kept, when possible, for one or two years in a thoroughly dry place, and they affirm that such keeping marvellously improves the resulting beverage. That is, however, a point more useful to the epicure and the gourmet than to the public, who only wish for a fairly palatable and refreshing beverage. Coffee, as we all know, requires to be roasted and ground.

Roasting.—This should be performed just before the infusion is required, and should be carried up to the point of producing a *chestnut brown* colour. It is usually carried out in revolving iron cylinders, and over a charcoal fire. It requires, however, the greatest judgment and knowledge, as on its *exact* performance depends, more than anything else, the flavour of the beverage.

Grinding.—Coffee should be ground as soon as possible after the previous operation has been completed. Once ground, the powder should be used without delay, or, if it must of necessity be kept, air-tight tin canisters, and not paper or tinfoil, are the only suitable receptacles. The aroma of coffee, like that of tea, being rapidly dissipated by a boiling heat, the common English practice of placing the coffee-pot on the fire to boil is a bad one. The best plan is to make an infusion first of all in exactly the same way as with tea: to pour that into a receptacle, then to boil the grounds, and to add the boiled water from that to the infusion. The French and other continental nations possess no special secret for making coffee. They merely regard the preparation of that beverage, as they look on cooking generally, as an art, to the perfection of which time spent in a little thought and labour is not thrown away. On the Continent, again, the consumption of strong alcoholic beverages is not so common among the lower classes as in England, and, as a result, their powers of appreciating shades of taste and flavour are much more perfect, and thus a general demand and a good sale for well-prepared coffee are always assured.

Coffee possesses less tannin than tea, and, therefore, never requires the addition to its infusion of soda. It possesses slightly laxative properties.

There can be no doubt, however, that in some persons of nervous temperament the stimulating effects of coffee on the nervous system are well marked, and that to such the beverage must be forbidden. Tremors, distorted vision, palpitation, anxiety, and general excitation, are some of the symptoms which, however, when produced—which is comparatively rarely—are easily traced to their source, for they follow speedily the consumption of the beverage. Coffee is more nutritious than tea. Its nutritive value is increased by the habit of drinking with it large quantities of milk. The leaves of the coffee plant are sometimes rolled and sold as a substitute for tea leaves, which in composition they closely resemble. The infusion prepared with them has a taste like that of a mixture of tea and coffee.

The roasted root of the dandelion, and of the wild endive (chicory), are common adulterations. They lack the aroma and the invigorating properties of coffee, but are otherwise unobjectionable. A good test for these adulterations is to add a small quantity of ground coffee to a wineglassful of cold water. Pure coffee will float and scarcely tinge the water; chicory and dandelion sink and impart a *deep red* colour.

Guarana and coca leaves are sometimes used as substitutes for tea and coffee, to which they approximate closely in properties. They, however, do not part in boiling water, as do the latter, with their essential oils, and therefore find rather in medicine than in the domestic circle their most useful application. As tinctures they serve, in my experience, very useful purposes in typhoid and other prolonged fevers.

Cocoa (which must not be confounded with coca) is prepared from the seeds of the Theobroma Cacao.

Cocoa nibs are the kernels of the roasted seeds, deprived of husk and roughly crushed. A decoction, made by gently boiling the nibs for two hours and then straining off the liquor, is *light* and nourishing, and in cases of dyspepsia forms an admirable substitute for tea and coffee.

Prepared Cocoa.—The kernels in this preparation are ground to a paste, and mixed with some starchy or saccharine substance, to diminish their richness. Carrageen moss, Iceland moss, and ground lentils are, in some preparations, added, to further increase their food value. When cocoa has been combined with flour and starchy material, *boiling* with milk or water is required, to produce a homogeneous mixture, and to render the starch digestible. Such a preparation is *thick.* The prepared cocoas which do not contain that ingredient require no boiling, but merely the addition of boiling water or milk, to prepare the beverage. These latter infusions possess a finer flavour, and are more digestible than the decoctions which contain cocoa plus starch, and are the only suitable ones for employment as food in early infancy The nutritive power of cocoa is very high. Deprived of all water it consists of 50 per cent. of hydrocarbons (fats), 22 per cent. o sugar (carbohydrates), and 20 per cent. of albumen.

Chocolate is a flavoured preparation of the finer kinds of cocoa. Cocoa contains a stimulating property, theobromine, which possesses a close analogy in composition to theine and caffeine. It contains no tannin. On account of its richness in fat, prepared cocoa does not agree well with some stomachs, the decoction of the nibs being, in such cases, preferable.

I would willingly have closed my remarks upon non-intoxicating beverages with a list of new and palatable fruit or other beverages, but my own efforts to prepare such, or to find formulæ for the making of them, have not been rewarded by success. There is absolutely no literature on the subject. I possess one book which *names* 365 of them ; but the author, when applied to for advice, frankly admitted his inability himself to prepare his beverages, or to point to any authority who could do so. Fruit jellies, dissolved in boiling water, and some of the better preparations of lime juice, are the only ones I know of; and they can scarcely be conscientiously recommended as palatable.

Zoedone, phosphodone, etc., are to be regarded as medicines, rather than as beverages ; and potash, soda, and lithia water are to be ranked with the weaker mineral waters.

ALCOHOL.

As a food, alcohol occupies quite a unique position, as far as its chemical relationships are concerned. I have divided all alimentary substances into the albumens (or nitrogenous foods), the carbohydrates (or starchy and saccharine foods), the hydrocarbons (or fatty foods), and the inorganic salts; and I have laid down the rule that every article capable of affording nourishment to the human body must consist of one or more of the four above-mentioned varieties. Alcohol, however, forms an exception to the rule, and stands between the starches and the fats, in a separate chemical order. But has alcohol any claim to be regarded as a food? This question has been very hotly discussed. Liebig took it for granted that it was one; and, owing to his high standing in the scientific world, his views were long accepted, without question. A reaction, however, set in, when MM. Lallemand, Perrin, and Duroy, in France, and Dr. E. Smith, in England, concluded, as a result of their experiments, that alcohol, when consumed, was *all* given off by the kidneys, lungs, and skin. Their conclusions were, however, much wider than the premises warranted. They established beyond all doubt what had been, hitherto, an unknown fact, namely, that alcohol passed off by the various channels named, but they did not by any means establish the point that it *all* passed off in such a manner. Their experiments were, further, conducted with too large amounts of alcohol, and it was pointed out that the excess over and above that which the system had power to absorb was all that was excreted, and a comparison was inferred between the effect, in this respect, of *excess* of alcohol and of grape sugar, which latter also, when taken in too large an amount, runs unchanged through the system. Further doubts were subsequently thrown on the utility of the tests employed by those observers. It was shown that in undoubted teetotalers a substance is eliminated by the urine, and probably also by the breath and skin, which, while presumably not alcohol, yet yields acetic acid on oxidation, and becomes emerald green when in contact with an admixture of one part of bichromate of potash to three hundred of pure sulphuric acid—results which, previously, were supposed to be characteristic of alcohol alone, and were those on which the observers that I have named wholly relied.

It was then contended by the supporters of the idea that alcohol was not a food; that though but a small amount of the imbibed alcohol can be found in the excretions within 24 hours of its consumption, yet that it very possibly might take days to completely eliminate it from the system. This supposition was somewhat difficult to directly refute, for it was not found possible for a series of six or eight days to collect all the breath, exudations, etc., of an individual; but nevertheless, Dr. Dupré, in his communications to the Royal Society, in 1872, managed very ingeniously to disprove this thesis. He proceeded as follows:—" Assuming, for the sake of argument, that all the alcohol is eliminated, and that such elimination takes ten days, it would follow that if a certain quantity of alcohol were taken daily, the amount eliminated must *increase* from day to day, until we should soon reach a day when the amount eliminated would *equal* the daily consumption; when, in other words, the quantity excreted might be measured by ounces instead of by grains, and that thus even the most ordinary processes of analysis could not fail to yield considerable quantities of the substance in question.

Now, to determine the above points, Dr. Dupré undertook a series of experiments, the results of which may thus be summarised:—1st. When a *fixed* quantity of alcohol is given each day, the daily elimination of it does *not* increase. 2nd. That in from nine to 24 hours after the last dose of alcohol has been consumed, its excretion by the body ceases. 3rd. That the amount of alcohol eliminated by all the channels is but a fraction of that consumed. Of course the only logical deduction that could be drawn from such experiments—the exactitude of which were, on all hands, admitted—was that the larger part of the alcohol consumed was retained and altered in the body, and was therefore, in some sort, a food.

Its mere alteration in the system might not seem, however, a sufficient ground for classing this substance as a food; but *combined* with the slow elimination of the unchanged balance, and with the notable tendency in alcohol drinkers to deposit fat, it rendered the conclusion that alcohol is a food practically unassailable.

Alcohol is then an undoubted food, but not a *convenient* one. It possesses several special qualities, which, though of service in certain cases where the bodily functions are disordered, are decidedly disadvantageous in a state of health. Thus, by reducing the oxygen-carrying powers of the red blood cells, it lessens oxidation of food stuffs in body, and fat is more rapidly stored up. This is a disadvantage in health, but is a manifest *advantage* in fevers, where the body fat is destroyed at a rapid and dangerous rate, and where its destruction is succeeded by that of the tissues themselves. Alcohol is further rapidly available as a food after it has been swallowed. It is thus of use in states of sudden and dangerous exhaustion. Furthermore, alcohol (in most of its forms) requires to pass through but little change that we know of before absorption into the blood, and, therefore, needs no digesting. It is, therefore, occasionally useful as a food where the digestive power is in abeyance.

Dr. Lauder Brunton has very aptly compared alcohol as a food to sulphur as a fuel. Sulphur is a fuel, but it burns so easily that it is neither an economical nor a convenient one. It is useful, however, as a tip for matches when what is required is a *quick* fire. Further, while burning itself, it will stop the burning of other substances. If a handful be thrown on the burning coals when a chimney is on fire the rising sulphurous acid produced extinguishes the burning soot. Alcohol, then, is both a food capable of being converted into heat and energy, and possesses also the power of arresting partially a similar conversion in other foods.

Pure alcohol, which has a specific gravity of ·794, at a temperature of 60° Fahrenheit, is the product of repeated distillations of fermented liquor, all contained water being, during the last steps of the operation, abstracted by means of carbonate of potash or quicklime.

Rectified spirit is pure alcohol, plus 15 per cent. of water. *Prooj spirit* consists of pure alcohol and water in about equal proportions. This latter (proof spirit) forms in England the Government standard, the various alcoholic beverages being judged to the above or below proof by their specific gravity, which is ascertained by means of a very simple little instrument called a hygrometer.

Brandy, which consists of pure alcohol and about 58 per cent. of water, is produced by the distillation of wine. The best is made from white wine. The flavour and aroma are due to the œnanthic ether and the volatile products belonging to the wine from which it is made, and which pass over with the alcohol in the act of distillation. Brandy is more easily tolerated by the stomach than any other spirit.

Rum is the result of the distillation of fermented molasses and water. Sliced pine-apple is sometimes placed in the puncheons of the choicer brands. This constitutes pine apple rum, and calls up visions of the Rev. Mr. Stiggins. Like brandy, rum is usually coloured with burnt sugar, and is greatly improved by keeping. The strength of both is also about equal. Owing to the large amount of unfermented saccharine substance it contains, rum has a strong tendency to produce acidity.

Whisky is about equal in strength to brandy and rum. It is one of the so-called *corn spirits*, and is prepared from *malted* grain, usually in this country from malted barley. Its peculiar flavour depends on the kiln-drying of the malted grain, the use of peat imparting, for example, a peculiarly smoky flavour.

Gin is the product of the distillation of *unmalted* grain. It should be twice distilled. The flavouring is usually derived from the juniper, hence the name *gin*, from *gênièvre*, the French for juniper, hence also the term Geneva gin. Both whisky and gin would be completely flavourless, consisting as they do of pure alcohol and water, were it not for the flavouring obtained by the former in the act of distillation, and by the latter from the added juniper. The effect of the addition of this substance to gin is to endow it with slight *diuretic* qualities. Unlike the other spirits, gin does not improve by keeping.

Beer and Stout.—Brewing consists of three operations, the production of an infusion of malt, the boiling of malt with hops, and the fermentation of the product. A pint of beer contains about one ounce of alcohol, *i.e.*, that amount which, according to Dr. Parkes, a man, with ordinary exercise, can take per day without visible deterioration of health. The principal ingredients in beer, stout, and porter are :— 75 to 90 per cent. water, 2 to 9 per cent. of alcohol (to which its stimulating properties are due), 4 to 15 per cent. of sugar, dextrine, etc., to which it owes most of its nourishing properties, and bitter principles derived from the hops, and to which it owes its tonic properties. Pale malt, used in the brewing of ale, is dried at a temperature of 110° to 130° F. Malt dried at a higher temperature is used for the making of porter and stout; and to this so-called *high drying*, is due their colour. Malt is sometimes roasted like coffee in cylinders, and used as a colouring agent for some stouts. It is then called patent, or black malt. Stout is richer in sugar and extractives than ale, and is therefore more nourishing.

Cider and Perry, of about equal alcoholic strength with light beer, are prepared respectively from the fermented juice of apples and pears. The process of making these beverages requires, however, skill and care, as they tend very readily to undergo the *acetic acid fermentation*, a sour product, apt to set up diarrhœa and colic, being the result. When in sound condition, they form wholesome and refreshing beverages, more suitable to the gouty and rheumatic than beer and stout, to which latter they are however, viewed as foods, inferior.

Wine.—The use of this term is generally restricted to the product of the fermentation of grape juice. All *natural* wines, that is, all wines that consist *simply* of the fermented grape juice and are not *fortified* by the addition of spirit, contain less than 30 per cent. of proof spirit, and are admitted into England at an uniform duty of 1/- per gallon—the stronger, or fortified, wines paying a higher duty. The excise authorities class, very properly, under the name of *spirit*, all fluids containing more than 42 per cent. of proof spirit. The juice of all grapes, except that of the Teinturier grape, from which no special wine is made, but which is only cultivated for its colouring properties, is pale. *Red* wine is the result of the addition of the *husks* of the grape to the fermentation vat. These husks contain a large amount of *tannin*. The acids present in the wine change the purple colour of the husks to *red*, which colour is always retained by acid wines, but in such wines as fortified port, it will, after long keeping, and if no free acid be present, return once more to its original purple colour. The *natural* acidity of a wine depends upon the climate in which the grape is cultivated. Thus the more northern wine-producing districts (Rhine, Moselle, Bordeaux, etc.), give us acid wines, and indeed, in some unfavourable seasons, owing to deficient solar heat, the grape in these districts, may not even ripen sufficiently to make a drinkable beverage. Towards the southern limits of the wine-producing areas, we come on the sweeter wines, those of

Spain, Portugal, Madeira, Cyprus, etc., the product of grapes that, every season, reach maturity. The main constituents of wine are :—water, alcohol, sugar and extractives, astringent matter such as tannin, colouring matter, acids, ether, and volatile oils. *Sugar* is the *fermenting principle* in all wines, and must therefore always be present in the grapes from which it is prepared. This sugar becomes, with water, converted into alcohol and carbonic acid, the conversion being effected by means of the action of a plant allied to the yeast plant, which is present in the air, or is artificially added, and which acts on an albuminous body resident in the grape. Fermentation, when *complete*, exhausts the sugar present in the grape juice, and the result is a natural, more or less acid, wine, such as claret, hock, etc. But as the grapes from which these two varieties of wine are prepared, contain originally but little sugar, it might be inferred that, in wines, the product of sweeter grapes, fermentation would advance much further, and that, by the time all the sugar was fermented, a wine of great alcoholic strength would result. This is not so, for the following reasons :—Firstly, that as soon as the albumen present in the grape juice is exhausted, the yeast plant dies, and secondly, that even if, to prevent this result, more of such albumen were added, the alcohol which is produced by the fermentation prevents further fermentation by itself destroying the yeast plant, when it has reached in the whole fluid, a proportion of about twenty per cent. A certain amount of unfermented sugar is then left over, and this, and the fermented liquor itself, would now be attacked by another ferment, and converted to acetic acid, or vinegar, were it not that to ensure the keeping of the wine for almost an unlimited period, the wine grower adds spirit. Such wine is then said to be *fortified*. Thus new fortified wine is also *sweet*. This sweetness, however, disappears slowly, and the sugar, on which it depends, is converted into some other unknown substance, and thus fortified wines become, in the course of years, dry, and agree, as for example Port wine does when old, with people who cannot, without resulting acidity, consume the younger wine.

Natural wines, acid simply because the whole of their sugar has been fermented, do not tend to produce acidity if they are in sound condition, but, on account of their small amount of contained alcohol, they rapidly become sour (converted into *acetic* acid or vinegar) when exposed to the air, and after a year or two, even when very well bottled, they cease to improve, and tend to lose flavour. The acids naturally present in sound but acid wine are principally the *malic* and the *tartaric.*

Effect of Wine.—A good wine should have a clean, sound, and simple taste; should impart a feeling of satisfaction, a slight glow to the skin, and an acceleration to the pulse. It should, beyond anything else, leave no bad taste in the mouth next day, nor should it cause acidity within two or three hours of drinking it.

The following are groups of the better known wines. I give the dry and natural wines first :—

Clarets—Lafitte, Sauterne, Latour, Margaux, Monton, La Rose, St. Julien, St. Emilion.

The alcoholic strength of both white and red claret varies from 18 to 22 p.c. of proof spirit. They form, especially the better white varieties, excellent invalid wines, being light, digestible, and dry.

Burgundies resemble in general character the Clarets, but are more full-bodied and find their greatest utility in cases of prostration and in states of bloodlessness. As a dinner wine, this wine appears with game or roast joints. The white varieties are, as in the case of the clarets, those best suited for delicate digestion. Chablis, Pouilly, Hermitage (white), Meursault and Montrachet are amongst the best known of these. Of the red varieties, Volnay, Chambertin, Pommard, Beaune, and Clos de Vougeot and Nuits St. George, are the more commonly consumed in England. Sparkling forms of Pommard, Meursault, Hermitage, and Romanée may also be procured, and are particularly suitable for cases of great prostration occurring in persons of feeble digestive power.

Champagnes, unless of the very best brands, are the least suited wines for the dyspeptic and invalid. Clicquot, Carte Blanche, 1880, dry Pommery, and Gréno's extra sec., Ayala's extra quality (dry), Heidsieck's Dry Monopole, Moet's Brut Imperial, 1880, are amongst well known varieties that are safe.

Hocks, from the banks of the Rhine and the Moselle, in general character approach the Clarets, but possess a finer aroma and flavor. As a light dinner wine for the dyspeptic, they are, perhaps, unrivalled. Johannisberg, Rudesheim, Liebfraumilch, Hochheim, Scharzberger, and Braumeberger are amongst the *still* varieties, Sparkling Assmanshausen, Flower of the Rhine, Sparkling Johannisberg, &c., are of the effervescent kinds.

Hungarian Wines closely resemble the Clarets. Carlowitz and Ofner among the red, and Ruster and Oedenberg among the white, are perhaps those which find most acceptance.

The Greek Wines, with one or two exceptions to be mentioned later on, are dry. They resemble in general character the Clarets, but are of greater alcoholic strength, and improve by keeping. The white varieties are very superior to the red, which have a somewhat rough taste. Kephisia, Sparkling Patras, White Ionian, Muscat, St. Elie and Vino D'Oro are examples of the white sorts.

The Australian Wines approach in general characteristics the Burgundies and Clarets. Light, wholesome, and rich in aroma, they are in sickness and convalescence infinitely to be preferred to the spurious Ports and Sherries so commonly consumed by invalids. In my opinion they cannot, however, as yet be said in flavour and cleanness of taste to compete seriously with the better European wines.

Spanish Wines.—Of the dry sorts Manzanilla and Mantilla are good examples.

Sweet Wines: *Port.*—Though sometimes imported as a natural wine, it finds, as such, but little sale in England and amongst the majority of people is only recognised as Port wine in the bottled, fortified, state. When in the latter form, and young, it must be rigorously shunned by the dyspeptic, for it is rich both in sugar and in tannin. After long keeping, these drawbacks to its consumption in great measure, if not entirely, disappear. When mature it may with confidence be administered to the convalescent whose digestive capabilities are fair.

A wine known as Red Tarragona or Spanish Port is largely sold, and when obtained from sources which are a guarantee of its purity, it serves for people of limited means as a very fair substitute for mature port.

White Port (Donna Blanca, &c.) is an excellent wine, containing, like all white wines, but little tannin

Sherry.—This name is a generic one for all wines from Spain. Like Port, Sherry is occasionally imported as natural wine. It is then light, clean, agreeable, and digestible, but finds no ready sale from the idea so generally prevalent that Sherry should possess more stimulating powers.

The natural colour of all Sherry is pale, the golden and brown colours are artificially produced to please the eye of the consumer. The additions made for that purpose slightly modify the taste. Young fortified Sherry possesses the same vices as Port in a similar condition, acting almost like a poison in persons prone to acidity. Like Port, it loses its drawbacks after being long in bottle. It need scarcely be said that by far the larger quantity of Port and Sherry sold is simply a manufactured article, and contains but little fermented grape juice; and even that little not often derived from the vineyards of Spain or Portugal.

Marsala, from Sicily, is, price for price, better than Sherry.

Madeira and Malmsey come from Madeira. They are full-bodied, and possess choice aroma. They improve by keeping.

Of the rarer sweet wines mention may be made of French Port or Rousillon, which, like Tarragona, is a cheap and good substitute for doubtful Port; Tokay, a very choice wine, from Hungary; Lachryma Christi from Greece; Bucellas, Lisbon, and White Port from Portugal; Malaga from Spain, and Constantia from the Cape of Good Hope.

CHAPTER XVII.

STIMULANTS AND STIMULATION.

THERE is a wide difference between the scientific and the popular definitions of the words, stimulants and stimulation. To the lay mind they signify nothing more than the "alcoholic question ;" to the scientific, they represent important investigations into the condition of the vital energy and the nerve structure of individuals, and the resulting ever-varying effects produced on them by the agency of certain abnormal impressions, of which alcohol forms but one in a long list of agents. I cannot help thinking that the exceedingly narrow popular view taken of this question in England has largely crippled the powers for good of many of those benevolent schemes, the object of which is to ween from slavish and brutish habits the unfortunate victims to alcohol. The teetotal cause has attracted to its standard a vast array of emotional and weak people who do not possess often the least acquaintance with the subject upon which they can be so eloquent. Many of these are constitutionally too weak to drink much alcohol, but indulge freely in emotional religious services and other forms of mental excitants, from which they derive much self-gratification. Many have a natural antipathy to alcohol ; many join the standard because all new movements have a fascination for them ; many because they hope to derive directly or indirectly pecuniary profit therefrom ; and a small minority because they are honestly desirous of promoting the welfare of their fellow man, and are willing cheerfully to face ridicule, and to undergo some little self-denial, to attain that end. But these societies have not yet secured, to any great extent, the right material, the higher professional class, the leading business man, the politician, or even the better class working man. All these feel a repugnance to the intemperate advocacy of temperance, the vague declamations and illogical tirades against beverages which their common sense tells them can, in many cases, do no harm, since the most highly civilised nations have partaken of them for centuries, and the Founder of their religion did not condemn their use.

I propose in the following pages to trace the rationale of all stimulation; then to devote a few lines to alcohol especially; and, finally, to sketch out the most rational methods of procedure when we have to guard against the commencement of the habit of spirit drinking, or to rescue from utter bankruptcy, and to restore to the right path, the unfortunate victim of it.

STIMULATION IN GENERAL.

In the early part of this book I have spoken largely of vital force or energy, and have endeavoured to make clear the cardinal fact that every individual possesses at his entry upon life a certain measure, varying widely in different persons, of this power. I have also been careful to explain that by this term I do not imply that such force is a special and distinct one, peculiar to man, or even to man and animals in general, but is rather to be regarded as of the nature of simple potential energy resident in the ovum, the physical basis and starting-point of the individual, the slow and gradual conversion of which into kinetic or moving force determines the growth and peculiarities of the being, and his duration of life; death ensuing when the conversion is completed. This vital force cannot be recruited. It may be heavily drawn on by the spendthrift, whose motto is " A short life and a merry one," or it may be husbanded by the man who leads a well-regulated, a physiological, life; and thus the latter, though possibly starting with an ovum of deficient energy, may outlive by many years the more richly endowed but more improvident individual. We have also seen that vital force demands, for the proper manifestation of its powers, the presence of other forces which are found in nature in the form of the various foods. The latter do not, it is true, actually feed the vital power, for feeding implies maintenance of, or even increase in, growth. To use a popular simile, I may say that they bear in many ways that relationship to the vital force that his appliances do to the juggler. The power of performing the feats of legerdemain resides in the juggler himself, but the actual manifestation of his powers depends on the supply of necessary appliances; so, without food, the human machinery slows down, eeds on itself, stops, and, though vital force may, like the juggler be present, and possess extensive powers, yet, unable to manifest itself, it is reduced to impotency, and the human mechanism falls to pieces, and its contained vital forces are converted into other varieties of energy.

Now, when a sound human body, placed under favourable conditions for the maintenance of health, is daily taking in a sufficiency of food; is efficiently digesting that food in the stomach, intestines, liver, and tissues; and, by the aid of reasonable exercise and pure air, is turning it to account for the maintenance of necessary heat, for the repair of necessary waste, and for the production and storage of necessary energy; it may be regarded as being in a state of physiological repose or equilibrium—burning, indeed, so to speak, the fire of life, but burning it gently and regularly. Were mankind content with such existence, human happiness would in the end be, if not actually increased, at least more evenly distributed over the period of each lifetime, fewer of the strong contrasts to it, which we call pain, would have to be encountered, and the average prolongation of life, and the diminution of disease, would be certain sequences. The various animals, we may justly conclude, feel, in their natural state, after having fulfilled the instincts necessary for the maintenance of their life and the continuance of their species, no further aspirations, a condition which we may sometimes observe in the least intellectual of the rural classes, who desire nothing further than health, shelter, food, and a female companion—*domus et placens uxor.* With such a state of lethargy the contentment which arises from the operation of the intellectual forces, and flows from the use of reason, must not, of course, be confounded.

Unfortunately, perhaps for man, the store of vital force with which he is endowed is given to him, as the children would express it, for his "very own." A certain daily expenditure is necessary for his existence, but this fixed amount may, at his wishes and commands, be constantly, or intermittently, in excess; and, of course, in proportion to such excess will be the advent of eventual bankruptcy. Now the human body is less an entity than an assemblage of communities called organs, each of which, and indeed each cell-unit of which, posseses its due share of the original fund of vitality; and, therefore, what I have said of the body as a whole, applies with equal force to each separate organ. The heart, as in the athlete, or in the man with imperfect cardiac valves; the liver, as in the gouty; the brain, as in the drunkard and chloral drinker, may be overworked, and the early breakdown of each organ will necessarily be in proportion to the overtaxation of its powers; much, of course, being also dependent, as we have seen in dealing with the early development of gout, upon the original perfection of the failing organ itself.

How can we overtax, or in other words *stimulate*, an organ and its component cells? Only by sending more than the natural and necessary amount of blood to it, or by detaining too much blood in it. By either means we supply more working material and more food, and *compel*—for the action of all cells is purely mechanical, and dependent on blood supply—more activity on their part. It is true that we reach a limit and have to stop there, and that, short of this point, we have to suffer a species of reaction unless we continue and increase the amount of our stimulus. The reason of this is to be sought for in the fact that cells are possessed largely either of actual elasticity, or of an energy akin to it. If we pass a certain limit, we destroy the structure, and with it, of course, all elasticity, but up to that point we find that this power is ever in operation, bringing back the tissues *nearly* to their original form, composition and function. But there exists, as we all should know, a law in physics that no solid body possesses perfect elasticity; each force acting on it leaves behind a permanent, though perhaps an extremely slight, effect; and thus it comes about that repeated stimulation—nay, even repeated use—must lead in the long run, spite of all reaction, to premature exhaustion and decay. The elastic power in ordinary india-rubber is very conspicuous, but we know, by experience, that it becomes weakened considerably in proportion to its use. True, the loss, to our minds, appears very slow and gradual, but compared with some substances, such as glass, ivory, and the cells of the human body, it is extremely rapid. Thus we see that this elastic power of reaction does not, cannot, save from the results of stimulation, which always must leave behind it a small account against the employer of it, on the debtor side of the book of life.

Our present position, then, may be summarised thus :—Man can, by an over-supply of blood to any organ, cause that organ to exhibit an excess of vitality ; but such over-supply, or stimulation, leaves, in spite of the elastic reaction which spontaneously ensues, a small, but permanent and indelible mark on the cells ; in other words, a small loss of their vital power, and a proportionately early tendency to their decay and death.

Now, almost the sole object for which stimulants are had recourse to is to excite the brain ; and disastrous as are the results on that organ, as shown in the premature loss of its powers, yet, in the case of alcohol, as we shall see in future pages, they are rendered all the more terrible by the fact that the stomach, the liver, and the kidneys, through which the alcohol passes, undergo a similar excitation ; and though such an effect on these organs is not desired by the individual, since it conduces in no way to heightened sensation, yet the results of it, their early degeneration and decay, proceed, pari passu, with that going on in the brain.

But we must confine ourselves still to the *general* question of stimulation. *It is desired to stimulate the brain, for which purpose more than the natural allowance of blood must be sent to it or detained in it.* Thus whatever increases the action of the heart will, to some extent at least, act as a brain stimulant. Therefore we find that ether, opium, alcohol, Indian hemp, kreatin (a substance found in meat), theine and caffeine, all heart stimulants, have a marked effect on the brain. Stimulating sights, sounds, thoughts, odours and tastes, have an equal power. All of these latter produce the retention of an undue amount of blood in the brain, by causing a dilatation of the blood vessels there. Thus these last-named stimulants, which enter by the eye, ear, and nose, in the form of strong impressions on their nerves, do not act through the medium of increased heart's action, but directly on the brain itself; the result, however, being the same, namely, an increased blood supply. Now, inasmuch at all* stimulants thus act by producing, first of all, an impression on some external or internal portion of the body, which impression is, by the agency of the nerves which convey impressions to the brain, carried directly or indirectly to that organ, it follows that the effect produced on the nervous system, and thence transmitted to the brain by a given amount of any stimulant, will vary very widely with. the impression-carrying power of the nerves, and the receptive and retentive power of the brain. Everyone is familiar with the various ways in which persons, even of similar age, race, and sex, are affected by witnessing a sensational play: some will weep, whilst others will be unaffected, and vote the spectacle a bore. In the same way, one man will be deeply moved by appeals to his sympathy, his love, his pride, his religious feelings, and another will not respond to any of them. The effects of precisely similar amounts of alcohol on different individuals is well known; one retains self-command, the other completely loses it, and throwing all caution to the winds, will make a confidant of the merest stranger. There are two great causes for this great difference in behaviour—*variation in the structure of the nervous system* and *habit or training.*

The individuals and races who are rapidly impressed, and whose brain centres respond readily thereto with motor manifestations, such as weeping, talking, laughing, fighting, fixation of tone in muscles rendering them rigid (*e.g.*, the cataleptic and the mesmeric), hysterical outbursts, etc., are called the emotional or impressionable. I have referred already to such persons in speaking of the necessity for their removal from the unwise sympathy and affection of friends in certain states curable by massage. Those who require massage are, of course, but extreme cases of the emotional temperament, which is an exceedingly common one, and which includes the vast majority of the fair, and not a few of the sterner, sex. Whole races exhibit it. Some of the most troublesome political and domestic problems depend on the conjuncture of people of this temperament with others of an opposite type. Similar facts are not viewed in the same light by the two classes. The stolid Anglo-Saxon, in addressing the emotional Celt, will often, in simple, clear language, quote figures, and give statistics, and draw therefrom logical deductions, which to his own fellow-countrymen would appear simply unanswerable. The Celt appeals to the emotions ; he discards all figures, and draws vivid pictures of starving peasantry, of hard-hearted landlords, of desolate houses and of untilled fields, of the deeds of valiant heroes, and the oratory of eminent speakers who have sprung from his native land. With his fellow-Celts such language carries a weight infinitely greater than all the hard-and-fast rules of political economy, than all appeals to the practical views of life. Such being the case, is it surprising that agreement between the Saxon and the Celt is impossible? Each honestly wonders that the other is not swayed by his arguments, and assigns the cause to perversity or ignorance. The same contrast may often be observed between men and women. A thousand little thoughtful acts of kindness and affection, insignificant appeals to sympathy, love, vanity, ambition, etc., sway and determine the more important actions of a woman's life ; though, to a man, it is positively inconceivable that such, to him, trivial causes can have on a rational being any considerable effect. They would simply have been lost on him. For this reason few, very few men, ever comprehend the opposite sex, though, especially amongst the so-called men of the world, there is a prevailing delusion to the contrary. The emotional Frenchman is, however, far in advance of the stolid Anglo-Saxon in this respect. On the other hand, a man's character is rarely so well gauged by a woman as by one of his own sex, though, from the rapidity of perception, and of the quick grouping of ideas, which are characteristics of her emotional temperament, she forms a more correct estimate of it than he does, when attempting to play the *rôle* of character-reader in regard to herself. I speak, of necessity, of typical cases only, as there are many exceptions to the rule.

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* Opium, alcohol, etc., and the whole class of what would be called the *material* stimulants, which I have spoken of as acting on the heart, really do so by acting from the stomach or the tissues on *the nerves* which guide and regulate the heart's action.

Stimulants, then, act either by increasing the action of the heart, and inducing thereby a larger current of blood to the brain, or by dilating the blood-vessels there, and retarding its outflow therefrom—usually in both ways.

If critically analysed, the great cause underlying our voluntary actions is always, or nearly always, directly or indirectly, the pursuit of pleasure—in other words the production of pleasurable sensation. In one man, it is hope of future heavenly bliss, in another the hoarding of wealth, and though both may be subjecting their bodies to rigorous measures in their all-engrossing pursuits, and may, to the unthinking, appear miserable and wretched, yet, in reality, they derive so much satisfaction from the contemplation of the ends which they have in view, that they are easily able to resist all proffers of assistance towards comfort, if such will in any way interfere with their ultimate objects.

Now, all pleasure is derived from and consists simply of sensation, and this again is solely derived from the impressions produced on sentient nerves. I have already spoken of reflex or automatic action, and have explained that, by means of it, the various movements essential to the continuance of life are ceaselessly performed. In all, even the simplest of those movements, is the reflex mechanism at work. The heart, for example, stimulated more than once every second by the inflow of fresh blood, telegraphs by the sentient nerves the impression produced thereby to the reflex centre, which responds by sending along the motor nerves that power which causes the contraction of its muscular walls and the expulsion of its contents. This is essentially the same process which produces our most complex thoughts, determinations and actions. The impressions on the sentient nerves of the eye, ear, mouth, stomach, nose, etc., are sent at once to the reflex centre. But not all the impression is *immediately* reproduced as motive power, as in the case of the simple reflex actions of the heart. Part of it returns, as a rule, as such, with a scarcely noticeable delay, but part is stored for a time with other impressions that have reached the brain from all the various parts of the body, and these are all grouped and mixed, but nothing is added thereto by the brain itself, the sum of the energies which reach that organ being precisely that of the motor energies evolved therefrom. A very powerful impression reaching the brain will, however, *liberate* many of the imprisoned thoughts. We have a good example of that in the effects of opium and alcohol. These *produce* no powers, no thoughts, but such as beforehand lay dormant in the brain, but they have the effect of setting simultaneously a multitude of them at large ; and, according to the stimulant used, and the portion of brain tissue affected thereby, will be the resulting manifestations.

The second great factor in determining the effect of a stimulant is *habit or training.* There is profound wisdom in Solomon's injunction to train up a child in the way he should go, that when he is old he may not depart from it. Whatever the habit or training, be it good or evil, it is intensely difficult to overcome its effects. Never is this more apparent than in the recourse to stimulation.

The tendency of habit is to convert voluntary, or so-called volitional, actions into reflex or automatic ones. It is probable that most, if not all, our reflex actions have been volitional ones that have undergone this change. It is certain that we may frequently, in every-day life, witness examples of the metamorphosis. Observe a child or an ignorant adult spelling through a reading-lesson. Each word, nay, each letter, is a matter for deliberation ; in other words, the higher functions of the brain are being exercised. In a few years' time the same child will, without hesitation, be able to read his own and perhaps one or two foreign languages as well. The reading and comprehension of even the longest words have become nearly automatic, and whereas, formerly, the simple spelling lesson produced a disagreeable sensation of fulness in the head, these much harder processes now entail no headache : nay, even the subject matter of the books read, which at first excited interest, ceases, after a few repetitions to awaken any such sensation.

But let the youth now take up the study of a new subject, say mathematics, and he will, in his advancing lessons, re-experience all the old painful sensations of learning to read. Time goes on, and he becomes a wrangler, and the early mathematical problems, from the study of which headache had often forced him to desist before he had mastered them, are now solved with ease. Automatic has here again almost replaced volitional action. The tendency of habit, then, is to gradually lessen sensation; and contrast is necessary to reawaken it.

What is true of painful is true of pleasurable sensations. We all know how possession of a coveted object soon leads to loss of pleasure in it, and a desire again for something new.

But for this fact, the amount of pleasure derived from existence would be enormously different in the various walks of life, and wealth would for ever be capable of purchasing a new sensation, known as enjoyment; but this is far from being the case, since to the poor man but little is needed to produce the pleasurable sensation of a strong contrast. The world is rich for him in possibilities of producing pleasure, poor for him in possible pain, since habit has so deadened his sensitiveness to the latter, that contrast can no longer produce much of it. As regards the luxurious and rich, the case is different. Starting life with the same capacity for enjoyment, *i.e.*, the same amount of sentient nerve tissue as the poor man, they, by constant stimulation of the nervous mechanism on which it depends, prematurely exhaust it, and, if they proceed far, reach a stage beyond which they cannot go, and suffer from a dreadful hopelessness and *ennui* of the mind, and also, as a necessary accompaniment of nerve exhaustion, failure of the bodily strength; though still able to suffer acute pain from the loss of wealth and the ordinary unavoidable cares of life.

Those who know best the real lives and feelings of both rich and poor, will agree with me, that the amount of actual pleasure derived from life is pretty equal in the two classes, and is perhaps most abundant among those poor who have not, by following delusive appearances, imitated the rich in stimulating and exhausting their nervous systems, and reaped the same reward of hopeless and early physical bankruptcy, but who have led regular lives, rich in many a daily pleasure, derived often from insignificant circumstances unworthy the attention of the pampered, and blessed ever with the hope of something better to come, and the consciousness that, if it does come they will have so husbanded their resources as to be capable of appreciating it.

But to return to our subject-matter. This hunting after new stimuli, caused by the lessened sensations procurable by the older ones, leads naturally, if wealth be plentiful, to those enormities of luxury and vice to which certain states and individuals have, in various periods of history, attained. The descent down the slippery path was so gradual, so natural, to the unthinking and luxurious, as to pass unnoticed by themselves, though the culminating result may appear shocking to the poorer, simpler, hardier peoples of to-day. In races, as in individuals, the inexorable laws of nature form a Nemesis which follows those who absurdly seek to produce from a limited physical basis of nerve tissue an amount of sensation which it is absolutely incapable of. Nature is for ever closing the doors behind the transgressor; his voluntary acts gradually pass from beyond his control, and if, unfortunately, these be contrary to her rules and laws, she tends to propel him forward, by what we call habit, to his certain and rapid destruction.

I have already spoken of the natural tendency of constantly performed voluntary acts to become automatic, or something closely approaching thereto. Did the matter rest there, it might still be said that every unconquerable vicious habit was the direct result of a want of the exercise of the controlling powers of the brain, by the individual who is the subject of it; but here steps in the great fact of hereditary transmission. The individual at fault in the production of, say, the confirmed and inveterate alcoholic habit, lies often many generations back. Such an ancestor commenced the transformation of voluntary into involuntary action, and he *transmitted* the alteration in nerve tissue he had effected, which, growing stronger and less controllable with each generation, has resulted in an individual whose nervous system almost instinctively demands, at all risks and hazards, constant and free stimulation. Such persons have often assured me that they do not feel themselves on a par with the rest of mankind unless they are under the influence of the excitant which they favour. At the sight of these unfortunate beings, the physician is apt to long for that "arm of the flesh," which, to their benefit, and to the arrest of a further transmission of their deranged state, would consign them to some safe and secure retreat where, free from the onslaught of their enemy, their lives might pass calmly and harmlessly away.

"Why cannot you be like me, and pass the public-houses, and go home straight at night?" says the virtuous citizen to the slave of alcohol. Simply and solely, O virtuous man, because he is not like you. For no other reason whatever. The drunkard's highest ambition is, very often, to avoid drink, but he is drawn thereto with a force which it is frequently quite beyond his power to resist. True, he rarely proclaims that fact to the world, for he does not wish to be regarded as hopelessly weak, and prefers rather the character of being wilfully and perversely wicked; but he will usually inform his doctor of the fact, in language, the sincerity of which there is no mistaking.

To sum up—*What, then, is necessary to constitute a stimulant?* Any more than usually strong impressions on sentient nerves, which, going to the brain, cause a temporary increase of blood in that organ, and, as a consequence, a rapid emission of thoughts or actions. Stimulants are then force liberators, not force manufacturers.

What are the effects of a stimulant? To cause the brain to put forth, temporarily, a large supply of power of various kinds. The elastic reaction which ensues on the excitement of the brain-cells is however proportionate to the force of the impression produced by the stimulant on them, and brings on a period of mental and physical inactivity; which *nearly, but not quite*, acts as a counterpoise to the effects produced by excitation, a small *permanent* loss of function always remaining. In addition to this invariable loss, each repeated act of stimulation produces less effect in the way of sensation; and the acts themselves pass at last almost or quite beyond the control of the will. This state of matters is expressed, in popular language, by the terms of habit, or training, and its effects are widely recognised.

What leads to the habitual use of stimulation?

1. Habit, inherited (natural tendency) or acquired.

2. An erroneous belief that it is productive of an increased sum of pleasure. This, the original source of all desire for stimulation, arises from the want of knowledge that every act of stimulation leads in itself necessarily to *temporary* reaction, and to a small *permanent* loss of the future powers of enjoyment; also to ignorance of the fact that the effects of stimulation are not confined to

the brain—which, at least, gives some return for the ensuing damage,—but are shared in by the body at large, which gives *no* responsive sensation of pleasure whatever, but leads, by its derangement, gradually to permanent loss of all but painful manifestations.

3. Certain states and conditions of the nervous system which predispose to a recourse to stimulation, and to a more rapid formation of habit than others. Persons of the so-called neurotic temperament possess the most impressionable and most responsive nervous systems, which form what is called the emotional character: the hysterical, the hypnotic, the hypersensitive, the morbid, the fanatical, the mesmeric, etc., are placed, in medical language, among the *neurotic*. From what I have said, it may well be judged that the neurotic has a much stronger tendency to have recourse to stimulation, to become a slave to the habit, and to suffer more rapidly and acutely therefrom, than people of the sanguine, or of the lymphatic temperament.

4. Fashion, vanity, bad example, desire to avoid pain or to overcome fatigue, are some of the minor causes. Some may regard these as major and prominent causes: they are not really so. They act merely by *determining* those in whom one or more of the three main causes are at work to a vicious and mistaken course.

Usually more than one of the above factors is at work.

Now let us turn to our commoner stimulants. Of these, alcohol stands first in the frequency of its use, and the amount of damage it produces. Other sensual gratifications come next. The medicinal stimulants, opium, chloral, absinthe, etc., are probably third, and what are popularly called pure mental emotions follow last: the mechanism of all stimulation being the same, the different manifestations being dependent on the *part* of the brain affected.

Alcoholic Beverages.—This includes in its ordinary application a vast variety of substances, some of which possess so few of the purely alcoholic, and so many of the beneficial and nutritious ingredients, that they properly take their stand rather as foods than as stimulants. The English brain has, however, become so perplexed with the rantings of certain advocates of teetotalism that the above fact is apt to be lost sight of; and while I will cede to no man in my efforts to promote, by voice and example, temperance principles for all, and to urge and, if possible, insist on, the most rigid abstinence for those who, by acquired or inherited habit, have become or are likely ever to become slaves to alcoholic excess, yet I venture to doubt the expediency of sacrificing thereto established truths. As a matter of fact we may fairly class most malt beverages and many of the natural wines, such as the better burgundies and clarets, if taken in wise moderation, more with the various adjuncts and flavouring essences used in the preparation of foods, but containing a much higher food value than these latter, than with pure stimulants. Man can, no doubt, do without any of these adjuncts, but for the matter of that, so he can without jewellery, or collars, or boots and shoes, which, viewed from a purely natural standpoint, might be considered as harmful luxuries.

The strong forms of alcohol, which we call spirits, possess, on the other hand, a comparatively trifling food value, and are apt, unless very largely diluted, to cause a rapidly deleterious effect on many of the bodily tissues, and it is really to the *excessive and habitual* use of these that the term pernicious alcoholic stimulation strictly applies. Such abuse leads to a marked change in the brain, and therefore in the mental status of the consumer. The symptoms are so well known as scarcely to need mention. Prominent amongst them is a gradual loss of the powers of control, and of the sense of order and regularity, of duty, affection, etc. While the rest of the body is often comparatively vigorous the brain is in almost a senile condition, and the effect to the onlooker is often peculiarly painful. Not that the other bodily tissues escape ; the throat, the stomach, the liver and the kidneys, those organs with which alcohol may be said to come most in contact, suffer most markedly, a progressive degeneration taking place in them. The fat that is sometimes put on by the sufferer and regarded by him, and perhaps by his friends, as evidence of his maintenance of health, is in fact a direct evidence of the opposite, and will, like that produced by liquid oils, on the advent of serious illness, fade rapidly away.

Dipsomania is a very different condition from the chronic alcoholism to which I have just referred. The dipsomaniac is one who suffers from periodic attacks of mania, in which the motor manifestations take the form of a craving for ardent spirits, accompanied usually by a great tendency to eccentric or violent passions. The dipsomaniac may, during the attack, commit murder, but he cannot be held justly responsible for it. In this disease there is a marked recurrence of attacks, the patient in the interval being well or nearly so, and often a rigid teetotaler without the faintest temptation to drink spirits. The duration of these intervals may extend to months or years, but as with recurrent insanity in general, they tend to become shorter and shorter, and to end in chronic and incurable disease. In many cases, before the sufferer begins to drink, the onset of an attack is noticeable, as in other forms of mania, by restlessness by day, sleeplessness by night, grandiose and unusual ideas, and other signs of mental excitement. Hunger, fatigue, and pain are but little felt, and I have known a man in this state walk for miles without complaining of pain, and with no object in view, the soles of whose feet were covered with large blisters produced by the application thereto of strong blistering fluid by friends who thought thereby to confine him to the house. The attacks of dipsomania last a variable time, from two or three days to as many weeks or longer, the invalid resuming on their cessation his ordinary mode of life, and rarely, even to his more intimate friends, referring to the period of his illness, which is sometimes quite a blank to him. The subject of his failing, if mentioned to him, is regarded as an unpleasant one and rarely is an effort made to palliate or to explain it; in these traits dipsomaniacal attacks present a strong contrast to the drinking bouts of the chronic alcoholic, who tends to view them in a jocular light, and is often anxious to convince his friends that his course of life is a healthy and proper one.

With neither the effects of the other sensual stimulations, as distinguished from the alcoholic, nor with those which follow the habitual use of opium, absinthe, Indian hemp, etc., is it my purpose to deal here; so with a few remarks on what I have called pure mental stimulations, I shall pass on to the all-important subject of treatment, upon which I hope to throw some light.

Of familiar mental stimulants, I will select emotional religion as my type. Living examples of the existence of this variety may be seen in many of the preachers at the corners of our streets. Look well at the speaker. His brilliant eyes, his glowing face, his gesticulation, his hurried language, rich in pictures of endless bliss or of future torments, all attest beyond doubt that the individual is suffering from a mental intoxication, having much the same features as that which is brought on by alcohol. The listeners are evidently deeply impressed, and some of the more impressionable are, from their appearance, evidently drinking in, by the nerves of the eyes and ears, deep mental draughts of the stimulant. Possibly, in a few days, the quondam preacher is found to have decamped with a friend's wife and household goods. His former admirers are loud in their denunciations of him as a hypocrite. He is no more a hypocrite than he was a religious man. He is a perfectly consistent embodiment of the emotional man, with the inherent love of stimulation, and in his preaching he was probably quite in earnest. The Rev. Mr. Stiggins, with all his love of pine-apple rum, was doubtless a fluent extempore minister. Unfortunately we possess no records of his life in the pulpit. The emotional preacher bears just that relation to the practical follower of Him who said "Pure religion and undefiled. . . . is to keep oneself unspotted from the world," that strong alcoholic spirit does to a useful article of food; the former producing disordered sensations and leading to disease; the latter, though acting through the same channels, tending to result in the maintenance of a healthy physical and moral equilibrium. But in precisely the same way as the emotional preacher, though himself a sinner, may occasionally, by his vivid picture of bliss, or of torments, arouse some backslider to a sudden sense of his position and to a temporary effort, which, backed by other and surer means, may lead to a permanently reformed mode of life, so may the alcoholic stimulant, though itself a poison, in discreet hands, employed at the necessary moment, send once more the stagnating blood of the dying man with renewed vigour through his arteries, and sustaining him thus till more sure and permanent methods are available, be the means of procuring a renewed lease of useful life and work. But for everyday systematic powers of affecting good, all stimulants are impotent, and tend all to produce the same effects, exhaustion of the brain and its premature, sometimes its sudden, failure. When a wave of so-called religious revival sweeps over a country, it attracts, as does a magnet the needle, the great majority of the emotional persons to its ranks, and the rate of consequent insanity is, as statistics show, materially increased. Precisely similar results are witnessed after certain periods, as the first few days of the New Year in Scotland, when alcohol is indulged in to a very great extent; and during and after periods of great national speculation, as in the time of the South Sea Bubble and in the early days of railway construction.

PREVENTION AND CURE OF THE TENDENCY TO UNWISE ALCOHOLIC INDULGENCE.

I shall now confine my remarks purely to the above form of stimulation, for in Great Britain at least, it is productive of more evil for the present generation and for posterity than all the other forms combined. Those of my readers who have followed me thus far may have viewed my method of dealing with the causes that underlie alcohol and other forms of stimulation as somewhat analytical. But what has the superficial view of the question done to remedy this gigantic evil? Little or nothing. It has been wept and prayed over, but the upas tree still flourishes with undiminished vigour. Here and there a few twigs and branches have been lopped off, but the rest of the tree is all the richer in sap for the operation. Who is the most vigorous opponent of the opening of fresh public-houses, and who most ardently wishes for the closure of all but a select few? Why, the prosperous publican himself. The more restricted the monopoly, the more grist must come to his mill, and the less trouble need he take to supply his customers with a good article. No, we must cease to prune the tree; we must dig it up by the roots, and plant the tree of knowledge in its place. To do that it is not necessary to shut one public-house, or to do injustice to a single publican. My plan might even increase the number of licensed houses, but it would reform and elevate the whole trade, and convert the gin-palace into a resort of harmless enjoyment and reasonable refreshment, and even of mild alcoholic stimulation, for the weary man.

The following is the plan which I should wish to see adopted :—All children who come under government inspection should be compelled to pass an examination in elementary physiology, to include the whole plain unvarnished tale of the causes and effects of stimulation. The writing of an authorised text-book on the subject should be entrusted to a man whose knowledge and scientific acquirements are beyond all dispute, and it might receive the *imprimatur* of the three Colleges of Physicians, so as to carry with it the full weight of the highest medical authorities in the land, or it might be submitted to the approval of some scientific, not strictly medical, society, such as the Council of the Royal Society of London. The book should be enriched by as many demonstrations and descriptions of simple and unanswerable experiments as possible. I do not mean that the effects of alcohol on man should be a subject for class study, but that the certain and disastrous effects of stimulants on living tissues of every kind should be made perfectly clear, and that the grossness and absurdity of the popular error that stimulation increases in the long run human pleasure should be so demonstrated as to stamp as a fool anyone who held the contrary view. The book should, however, contain no strong language; its cause would be too just to need it, but it should furnish data that it would be impossible to refute. At the same time there should be no *suppressio veri.* All that can be said in favour of alcohol should be impartially stated. Nothing so much shocks the budding intelligence of young people, and leads in them to more violent reaction, than the discovery that their youth and inexperience have furnished ground for the planting of half facts and distorted truths that find no foothold in the intelligence of adult humanity.

Why does the London publican hang out large lamps, and consume, regardless of expense, untold cubic metres of gas within his bars and snuggeries, delight in well-polished brasswork, and vaunt the benefits resulting from the consumption of spirits, when he well knows that the glitter does not improve his stock, and that the virtues named are not resident in his liquors? Why does the nostrum vendor promise rejuvenescence to the aged, and perennial health, or a plenary absolution from the consequences of past vice, to the young and middle aged, when he knows that his drugs do not produce those effects? Why does the magnetic specialist speak of electricity as a rare and precious power, when he knows it is the most widely distributed of all the forces in nature?* and why does he hold out vain promises of cure by imparting this force to the invalid's body, when he knows that every cell, every atom there, already contains it, and as much of it as can be turned to any useful purpose? All these persons reckon on that love of glitter, of big words, and of wide promises, which experience has taught them exists in the ignorant of all ranks. These traders are following business principles; they have cut their cloth to suit their customer, and it becomes a nice ethical question as to whether much blame should attach to them for their proceedings. Instruct the ignorant, and those who prey on their want of knowledge will, in obedience to trade laws, disappear, or be compelled to resort to more honest pursuits. Train the eyes of the public to see the sneer, and their ears to hear the mocking laugh, which, unseen and unheard at present, accompany their all too ready and unreasoning credulity.

The thorough and compulsory instruction on all points referring to stimulation and a sound general knowledge of physical laws, are, then, I think, of the first importance. That a high-class classical, literary, or even mathematical training is quite consistent with the blindest belief in physical absurdities is a matter of almost everyday experience.

The second step in the direction of a general reformation of the national vice might also appropriately come from the Government, nor need it, any more than the first, be of an aggressive or unjust nature. Apply rigidly to the publican, as to the small struggling milk dealer and grocer, the provisions of the Adulteration of Foods Act. Let his stock in trade from time to time be subjected, like that of other dealers, to strict analysis. I do not mean that the excise authorities should, as they have recently done, swoop down upon the spirit dealer and assay his stock; for those authorities concern themselves, as indeed is their duty, merely with the amount of proof spirit present in the various beverages, with the sole object of ascertaining whether the publican, by the adding of water, or of sugar and water, be attempting to elude the full payment of the tax imposed on that article.

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* Electricity has a limited use in applied medicine, mainly as a temporary stimulant to muscular action. Electricity of the so-called static variety may be conveyed to an individual, and he may thus be charged with an amount in excess of his natural supply. But such excess is lost almost at once to surrounding matter, for, like water, electricity seeks its own level, and excess of electricity can no more be kept in a man than water in a sieve, unless the supply be constant. Even then, as any of my readers may demonstrate for themselves in a physical laboratory, the beneficial effects are, except in the very rarest cases, *nil.*

What I recommend is, that the amount of the deadly *amylic* alcohol present in the spirits, and the more varied but equally deleterious adulterations to which wines are subjected, should be searched into. The excise authorities do not look after such matters, which indeed are, I believe, beyond their legitimate sphere; but none the less is it to my thinking an urgent need that they should be inquired into. Monsieur Aglade, an eminent French scientist, in the course of a recent lecture delivered at the Sorbonne, stated that, in France, forty per cent. of the cases of mental alienation and most of the murders and suicides were directly traceable to the effects of alcoholic beverages rich in the amylic variety of alcohol. This form he further states is seven times more poisonous than *ethylic* alcohol, which is almost the sole result of the distillation of wine. Of the 1,872,000 hectolitres of alcohol consumed annually in his country, scarce 25,000 are, according to him, made from wine, the enormous balance being the product of the distillation of potatoes, maize, rice, beetroot, etc., which yield a preponderance of amylic alcohol. He illustrated his lecture by experiments on animals with the two forms. With regard to the special adulterations of wine he gave a formidable list of colouring agents and foreign extractives, many of which are known to possess poisonous properties. He concluded by referring to the vigorous health and the long life enjoyed by wine producers in the Burgundy district, who consume habitually large quantities of their best vintages; and he drew a vivid picture of the contrast they presented to the consumers of the doctored articles retailed in the cheaper restaurants. I fear that a critical research into the exact composition of the spirits, and especially of the public-house wines retailed in Great Britain, would yield even more startling results.

Not that the publican is to be blamed for this state of matters.

Professionally I have been brought in contact with many of the class, and from my observations I have every reason to conclude that their standard of morality is quite as high as that of the average citizen. They are not custodians of the public health, but merely act the part of middlemen between the manufacturer of alcoholic beverages on the one hand, and the public on the other. In obedience to the demand of the latter, they supply a certain article at a market price. The fines for adulteration should not fall on publicans if they could prove that they had purchased what they believed to be a genuine article, and had not tampered with it whilst in their possession. Indeed, I would grant to all the retail houses for wines and spirits a secure and prolonged licence, renewable only at the death of the proprietor, or at its transference to other persons, as compensation for the annoyance of the strict supervision which I would see enforced, and to encourage improvements.

TREATMENT OF CHRONIC ALCOHOLISM.

Were the means I have referred to for the proper training and education of children as to the real and inevitable effects of powerful stimulation, and the rigorous methods for the detection of impurities in alcohol, carried out, the number of cases of chronic alcoholism would diminish rapidly ; but, as these latter are often but the finished product of generations of the slaves of habit, it would take, doubtless, two or three score years to reduce this class to anything like small proportions, and in the meantime, the marrying and the resulting propagation of their defective nervous systems must, I fear, go on unchecked. But some check might, without any very great shock to the liberty of the subject be placed on the career of each individual alcoholic. Why not adopt the plan pursued in some of the departments of France? Let the first conviction for public drunkenness entail a loss for a year or two of certain civil rights, and the second and subsequent convictions, further similar penalties. The very dread of this branding would act as a powerful deterrent on many a commencing backslider. For very repeated acts of drunkenness, enforced seclusion in certain institutions for various periods, would prove at once a preventive, and a most powerful means, often the only one that exists, of breaking the habit. The secluded rich man would be maintained at the expense of his estate, the poor one could be compelled to work at some trade to assist in maintaining himself and those dependent on him for support. Crime, and forms of insanity, in which the patient is beyond the control of his friends, and infectious fevers, are regarded as sufficient causes for the interference of the strong arm of the law in the enforcement of temporary retirement from the world, and why not chronic drunkenness? In the name of common sense, why should the drunkard be allowed to commit a slow suicide, to ruin his friends, to be a standing cause of annoyance and danger to the lieges, to run amuck generally in the ranks of order and decency when states of mind and body not half as dangerous are zealously safeguarded by the State? It is true the drunkard may be arrested and sent to prison, but this only makes matters worse. The contact with criminals, the permanent stain on his character, the misery and distress often resulting therefrom to his family, do not tend to discourage a fresh resort to drink, but have the contrary effect. The magistrates themselves are most keenly aware of this, and I believe would welcome gladly a change in the law. Were the State to undertake such a course as I have sketched, the result must be that both powerfully deterrent and directly curative methods of a highly practical nature would be placed in the hands of society, which could not fail to materially assist, without making fresh criminals of simple drunkards as now, in diminishing the totality of crime. Of her it might then truthfully be said, as of the restrictions of Christianity,—"*Ligamenta illius, salutis alligatura,*"—Her bonds are a healthful binding.

Perhaps my readers may wonder that I have not dilated upon the various methods of treating drunkenness by means of medicinal agents; but none of these are worthy of any serious attention, as my readers will conclude for themselves if they credit me with having laid down at all correctly the causes that underlie the mischief. I have tried, against my better sense, the various drugs vaunted from time to time as specifics, carefully and patiently, and I have never had therefrom any tangible results that could merit the name of a cure for drink-craving. Tartar emetic will, by inducing intolerable nausea, often arrest a drinking bout; morphia, chloral, and Indian hemp, may with questionable morality, be offered to the toper as temporary substitutes for his favourite stimulant; red peruvian bark, in the form of the tincture, may restore tone and appetite; bromide of potassium may for a few days deaden desire; stomachics may render the retention of food possible, and thus, after a prolonged drinking fit, indirectly tend to relieve some of that intolerable sinking which may be keeping up the demand for spirituous drinks; but none of them have any *curative* effect on the drink-craving of the confirmed alcoholic, for whom, except in vary rare instances, there is no practical help but in seclusion.

With these remarks I dismiss this subject. My method of dealing with it may be open to hostile criticism, but I believe my facts to be strictly correct. I am afraid that many years will yet elapse ere any English Government will have the fortitude to deal with this question in a firm and practical spirit, remembering that the only proper study of mankind is man. His physical structure, and the effects produced on it by his surroundings and by inheritance, are the only sure basis on which successful legislation can be built. Emotion and sentiment, so superabundant in England, and so morbid that half its inhabitants can become hysterical over the loss of an elephant, should, and must be banished from the council-room when the subject of our great national curse comes before the legislators. The influence of that exalted egoism, called sentiment, so far has been productive only of harm, clouding the subject, influencing to weak and futile measures timid legislators and disheartening and disgusting all true and practical reformers.

FINIS.

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